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CRANBERRY CULTURE.

BY

JOSEPH J. WHITE,

A PRACTICAL GROWER.

NEW AND ENLARGED EDITION.

ILLUSTRATED.

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PREFACE TO NEW EDITION.

With the assistance of some of our most successful growers, the writer has endeavored to furnish a few facts for the guidance of those who are inexperienced in Cranberry Culture. A very small percentage of the land in any country is adapted to the growth of the Cranberry, and as the most experienced growers frequently fail in selecting locations, beginners are advised to proceed cautiously until their ground has been practically tested, and to observe closely the effects of drainage, flowage, etc., as it is impossible to prescribe rules for the management of every location. J. J. WHITE.

New Lisbon, N. J., January, 1885.

PREFACE TO FIRST EDITION.

In view of the rapidly increasing demand for a reliable guide, or text-book for the cranberry culturist, we have attempted, with the liberal aid of some of our most successful growers, to prepare such a work.

Our aim has been to embody, in a plain and concise manner, all the useful and practical facts which study and experience have yielded to the inquiring cranberry grower of the present time. The business has increased enormously within the last ten years, and knowledge and experience have kept pace with that increase. The insufficiency of the works upon this subject, which we have hitherto taken as books of reference, is very apparent.

We have endeavored to make this work as comprehensive as possible, and we trust it will prove an efficient guide to all who may have cause to consult its pages.

J. J. W.

Juliustown, Burlington Co., N. J.,
March, 1870.

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CRANBERRY CULTURE.

CHAPTER I.

NATURAL HISTORY.

The Cranberry is supposed to have been so named from the appearance of its bud. Just before expanding into the perfect flower, the stem, calyx and petals resemble the neck, head and bill of a crane—hence the name, "craneberry," or "cranberry." According to botanical classification, the Cranberry belongs to the Natural Order Ericaceæ, or Heath Family, and to the genus Vaccinium. Bilberries and whortleberries also belong to the same genus. There are two species of Cranberry growing within our territory—the Small Cranberry, *Vaccinium Oxycoccus*, and the Large, or American Cranberry, *Vaccinium macrocarpon.*

The runners of the *V. Oxycoccus* are very slender, being from four to nine inches long. The leaves are about one-fourth of an inch long, ovate, with strongly revolute margins. The Small Cranberry is found in the peat bogs of New England and Pennsylvania, and westward to Wisconsin, and northward.

C. L. Flint speaks of having observed it in the swamps of Provincetown, Massachusetts, where it is called the "Spice Cranberry;" it is also found in South America, and on the vast steppes of Russia, also occasionally in the wastes of Siberia.

The *V. Oxycoccus* flowers in June. The berries are about one-fourth inch in diameter, and often speckled with white when young; owing to its small size and acrid flavor, this species is seldom gathered for the market. It is said that in Sweden, the acid juice of this berry was formerly used to boil silver plate in, that it might eat off the minute particles of copper alloy.

The *V. macrocarpon* puts forth stems or runners varying from one foot to six feet or more in length. The tendency of these runners is to trail upon the ground, and send down numerous little roots to draw up moisture and nourishment for the flowering branches which ascend from the runners, at frequent intervals, to the height of from three to twelve inches. The leaves are oblong, about half an inch in length, and are covered with a whitish bloom underneath.

The *V. macrocarpon* also flowers in June, producing berries varying from one-fourth to one inch in diameter; these are of a light green color while growing, but when *fully ripe*, of a bright crimson, or carmine color. It is a native of North America, and is found growing naturally in the peat bogs of Virginia, and westward to Minnesota, also northward, and abundantly in the British Possessions. In Minnesota and Wisconsin it grows extensively, being gathered in large quantities by the Indians.

Its favorite resorts are swamps and morasses containing rich bottoms of decomposed vegetable matter, commonly called muck, or peat. These swamps are apt to be flooded during every wet term, especially in winter and early spring; but in the growing season they attain some degree of *dryness, without which the vines will not flourish.*

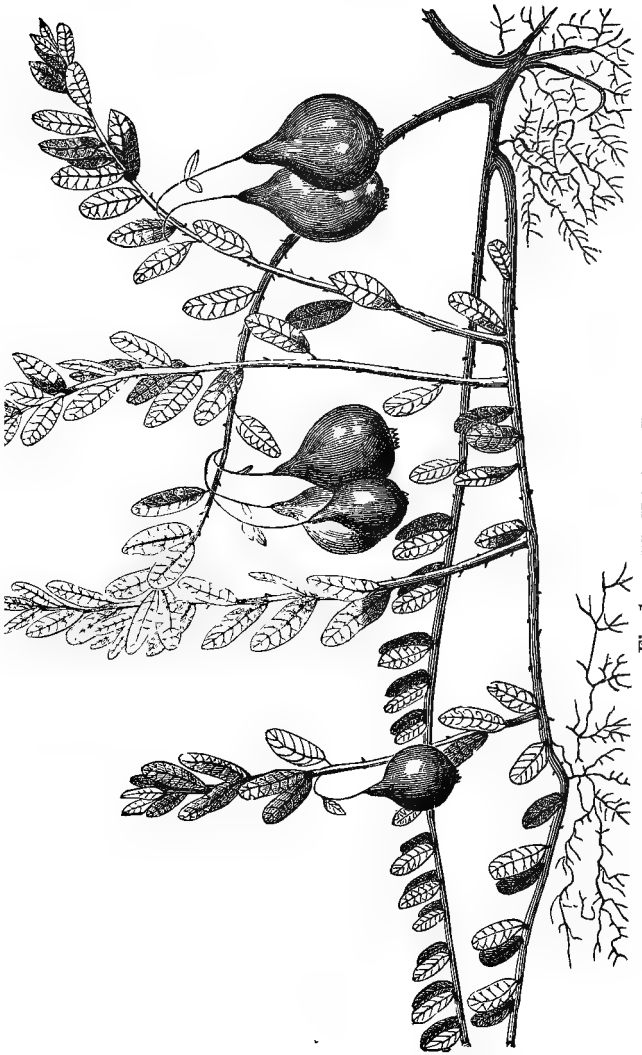

Fig. 1.—BELL CRANBERRY.

This is not apparent at first sight, as the vines appear to be growing in the water; but upon closely examining plants growing in a wet swamp, the roots will be found not penetrating the muck, as was at first supposed, but entwining themselves among the sphagnum moss above it (see fig. 14). The water settling away at certain seasons of the year leaves the moss comparatively dry, although it possesses the property of retaining sufficient moisture to support the plants, even in the dryest times.

ANALYSIS.

An analysis of this fruit was made, some years ago, by Professor E. N. Horsford, of Cambridge, with the following results in one hundred parts:

Water	88.78
Ash	.17
Woody fibre, organic acids, etc.	11.05
	100.00
Percentage of potash in the ash	42.67
" " soda " "	1.17

The berries were dried in a steam chamber at 212° F., and from these the ash determined by slow combustion in a platinum crucible.

The qualitative analysis of the ash indicated the presence of the following substances, viz.: Potassa, soda, lime, magnesia, sesquioxide of iron, sesquioxide of manganese, sulphuric acid, chlorine, silicic acid, carbonic acid, phosphoric acid, charcoal and sand.

From this analysis it will be seen that only seventeen one-hundredths, or less than two-tenths of one per cent of the Cranberry are found in the ash, as inorganic matter derived from the soil, all the rest being derived from the atmosphere and from water.

"The results of experience are, therefore," says Flint, "strikingly corroborated by the deductions of science,

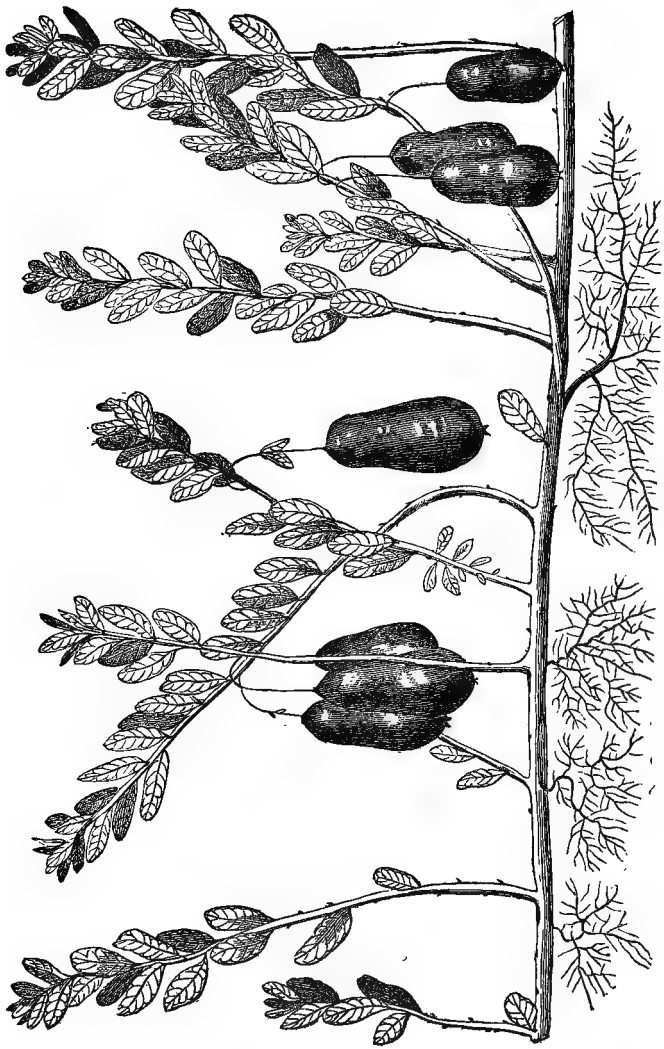

Fig. 2.—BUGLE CRANBERRY.

that the Cranberry will grow where nothing else will. It explains, too, how it is that it seems to require little for its perfect development but air and water."

The American Cranberry is divided, by writers upon this subject, into three varieties.

1st. **The Bell Cranberry** (fig. 1).—This variety is so named because of its resemblance to a bell in shape.

2d. **The Bugle Cranberry** (fig. 2), was so called from its resemblance to a bugle bead, being elongated, and approaching in shape to an oval.

3d. **The Cherry Cranberry** (fig. 3) is spherical in form, and somewhat similar in shape, size, and color to the cherry, from which it derives its name.

These varieties are to be known only by their fruits; the difference in the appearance or growth of the vines being insufficient to distinguish them. Although the different forms, previously described, are distinct, and well marked, one plant producing one variety only, yet cranberries are found existing in all the intermediate shapes between these; for instance, the Bell and the Cherry cranberries are distinctly marked, but many specimens are found bearing so much resemblance to both, that one could not tell to which variety they belonged.

There are, apparently, different varieties of vines also, some being lower and more trailing than others, but even these low vines produce fruit of various qualities. The largest cranberries we have yet seen—being about one inch in diameter—belonged to the Bell variety, and were grown upon vines of this character, originally obtained from a natural bog by John Webb.

Other characteristics exist beside the shape of the fruit, characteristics which are much more important, to be observed by the grower; for instance, if one goes into the market with the view of selling a lot of cranberries, the question is not What *shape* are they? but rather, Are they well *colored?* or, Are they of good *size?*

Fig. 3.—CHERRY CRANBERRY.

Color is the quality most regarded ; light colored fruit is suspected of being unripe. Color affects the price from $1 to $3 per barrel, the darkest fruit bringing the highest price. Dark berries are the most attractive, but pale ones are not always unripe. The fruit of an undescribed New Jersey variety is cream-colored when fully ripe, and remains so. It is large, a good keeper, and inviting on the table.

Many berries which ultimately turn red, are very light-colored at picking time, while others at that time are entirely red. Those disposed to become red, remain light-colored if shaded by the matted vines. There is a marked difference in the time of coloring of berries that are alike in shape and grown under the same conditions.

This fact renders the selection of vines for planting an important matter, since a small portion of light-colored berries will, if not removed, seriously affect the sale of the whole lot.

Vines producing red berries, ripening uniformly, are very desirable ; but there is no way of selecting the best vines, except by a knowledge of the fruit they produce, and this should be had, if possible, before using them.

In New Jersey and the Western States, but little attention has been given to the selection of vines for planting. Some years ago, a variety was discovered on Cape Cod, Mass., and called "Early Black." This has been extensively propagated on the Cape. It is dark red, matures several weeks earlier than the ordinary varieties, and commands the highest prices in the early market.

It is also an important matter, in transplanting vines, to secure those yielding large-sized berries, for the reason that fine, showy fruit is at a premium in the markets, and will always command the highest prices.

The appearance of one's marketing has very much to do with the price obtained for it in large cities, most of the inhabitants of which have but a slight acquaintance

with the different varieties of fruits or vegetables. The *best looking* are selected first; reasoning by analogy, they conclude that the largest and fairest must necessarily be the best, but in this they frequently err. Those varieties of fruit which are finest, and possess the highest flavor, are generally of medium size. We know of no especial difference in the flavor of cranberries, whether they be large or small. But the small varieties are certainly the best keepers, and also the heaviest, they being almost solid, while the largest sorts are quite hollow.

It has been asserted by writers upon this subject that there are two kinds of cranberry vines, viz., the productive, and the barren; or, as B. Eastwood terms them, the "healthy, and the unhealthy vine." He says: "The healthy vine, as far as we have been able to discover, presents an appearance of greenish-brown on the leaf; the spears and runners are fine and thin, remarkable for their wiry nature and aspect. They seem of stunted growth, but form beautiful and tufted groups of spears in their process of matting. The unhealthy vine appears altogether brighter and stronger, and hence, from this peculiarity, some are apt to be mistaken; for instance, a practical grower was disappointed in finding his most luxuriant vines, and those from which he had expected the best returns, barren. 'The barren vines,' said he, 'looked greener, had more bushy leaves and stronger or thicker spears than those which produced the most fruit.' I felt confident, from their appearance, that they were the best vines I ever saw; but I lived to find out that these signs, which I took to indicate the productiveness of the plant, were only symptoms of *disease*, which disease means *barrenness*."

Another failure, resulting from the same *cause*, has been brought to our notice.

A farmer near Bristol, Pa., desiring to cultivate cranberries, procured vines from several reliable growers in

New Jersey and Massachusetts, and planted them in low rich, meadow ground, which to him seemed suitable for them. They were carefully tended, and the growth was most luxuriant, but there was no fruit. Supposing a covering of sand would check the growth, he procured some at heavy expense, and spread it over them; still they remained barren, and after several years of unfruitfulness, were offered to a New Jersey grower for setting out a new bed. But the appearance of the vines condemned them; they had become almost as thick as pea vines, and the grower would not accept them, even gratuitously. Perhaps the only way of making this patch fruitful would have been to have covered the vines, during several sucessive winters, with as much clear sand as they would grow through, until a covering of six or eight inches had been placed upon the original soil.

We have visited hundreds of acres of cultivated cranberry meadows, the vines for which were taken indiscriminately from natural bogs, without reference to their kind or quality, and we have yet to see the first square rod of barren vines, the cause of which could not be traced to the soil on which they were growing.

Barrenness may result from two causes, viz., the soil may be too rich in vegetable matter, or it may be too poor.

The cranberry plant, like many others, if put on very strong land, will run to vine, and produce little or no fruit. The sweet potato, for instance, sometimes makes a great show upon the surface during the growing season, without yielding, when harvested, the abundant crop that its vines seemed to promise.

Generally speaking, where we hear of barren vines, we hear of a luxuriant growth. Productive vines, of good repute, have, to our certain knowledge, become fruitless by being placed under circumstances most favorable for their growth and development.

There are two remedies for an over-abundant growth of vine; viz., sand and water, of which we will speak more fully hereafter.

Another cause of unfruitfulness may be the extreme poverty of the soil. Sand is sometimes so deficient in vegetable matter as to produce little or no vine, and when this is the case, much fruit cannot be expected.

As before stated, the Cranberry grows naturally on moist bottoms; and soils of this character are the only ones upon which it can be cultivated profitably, although designing nurserymen have asserted to the contrary, with the view of disposing of their plants. By way of illustration we give the following, taken from the catalogue of an old established nursery:

"*The True Cape Cod variety*, now offered, is by far the best in cultivation, *and succeeds best in uplands.* There are several sorts in the market, known as the "Bell," the "Cherry," and many other fancy names, which do not compare with this, in real, practical value. *Plants, packed with great care*, $2 per 100, $10 per 1,000." To complete the deception, they quote a writer in the Maine Farmer, who says: "My crop, grown on *loam*, in 1863, was at the rate of 453 bushels per acre." Other statements are also made in the catalogue, which are calculated to mislead the unsuspecting or ignorant, and induce them to pay enormous prices for plants which will be of little or no advantage to them, if planted in the manner recommended; viz., "on upland," and "on loam." The policy of their assertions is evident; small fruits, for one's own family, are generally grown in the garden, upon selected upland, and every one owning such a spot would naturally desire to have this valuable fruit among his collection.

But comparatively few possess ground adapted to cranberries, hence unprincipled dealers recommend a system

of culture for the many, that they may sell the more vines.

There is a plant called the High-bush, or High Cranberry (*Viburnum Opulus*), indigenous to North America, found on uplands in many localities in the Northern States. C. L. Flint says: "It is a beautiful shrub, sometimes ten or twelve feet high, having a white blossom, and a fruit somewhat smaller than the common cranberry, perfectly red, and of an acid taste, well adapted for pies, tarts, etc., for which it is often used. The fruit differs from the common cranberry in having a small, oblong stone, instead of seeds. It is easily propagated from the seeds, layers, or cuttings, and is often found as a garden shrub, flourishing in every variety of soil, sands and clays, wet and dry. Its berries grow in clusters, and are persistent through the winter."

"The plant called, in Maine, the Mountain Cranberry (*Vaccinium Vitis-Idœa*), has leaves shaped like those of our common Cranberry, and bears an acid fruit, used for the same purposes as our cranberry. It is occasionally met with in Massachusetts, where it is called the 'Cow Berry.'"

There is still another plant (*Arctostaphylos Uva-ursi*, Spreng. *Arbutus* of Linn.) found in abundance on Cape Cod, and there called the Hog Cranberry. It also grows abundantly in the Pine region of New Jersey, where it is known as the Grouse Berry, Upland Cranberry, also Bearberry and Uva-ursi, and in some parts as "Universe," a corruption of Uva-ursi.

It is not properly a variety of the cranberry, but belongs to a different genus. Like that plant, however, it is trailing, and has leaves somewhat similar in shape. Its fruit is red, but smaller than the cranberry, and of a dry, mealy nature. Both fruit and leaves are used for medicinal purposes; the latter are also in demand among the inhabitants as a substitute for tea. The plant may be ob-

tained in large quantities from its native soil, the dry and barren sands of Cape Cod, and the Pines of South Jersey.

CHAPTER II.

HISTORY OF CULTIVATION.

Fifty years ago, one embarking extensively in the cultivation of the cranberry would have been comparable to a craft putting to sea without chart or compass. Doubts would have accompanied his progress, and the possibility of profit resulting from his labors have been exceedingly uncertain, for the reason that the wrong courses to be pursued were far more numerous than the right ones. Hence it was that the early cultivators ventured out very cautiously, risking but little of their labor or capital in the doubtful enterprise.

Many failed, but failures, although unpleasant, are not entirely without good results, and should be carefully chronicled, to the end that others may learn wisdom, and not fall into the same errors.

Some were partially successful, and their names have become connected with the business, although their achievements have been far surpassed by men of whom we have never heard; yet they were comparatively successful in their day, and they deserve our notice now, for having laid the foundation of successful cultivation.

These pioneers in the business were men of enterprise; for they not only encountered many difficulties in growing the fruit, but were unable to sell it, when grown, for remunerative prices. Strange as it may appear, when the supply of cranberries was very limited, and derived almost entirely from natural bogs, the price per bushel was

discouragingly low. For instance, about thirty years ago, two well-known merchants of Medford, N. J., invested in a lot of good, natural cranberries, with the view of speculation. The price paid was 62 cents per bushel, and yet they lost money by the operation.

The success of a few cultivators becoming known, others were induced to attempt the business, and as the supply gradually increased, the berries were exposed for sale in new markets, and people who had before been unacquainted with them were, perhaps, attracted by their fine appearance, and led to give them a trial in the famous tart or sauce,—a trial being sufficient to convince even the most skeptical of their excellence, and create a demand for them wherever they were introduced.

This demand, steadily increasing, even faster than the supply, caused the prices to advance, and as the business became remunerative, growers were multiplied in numbers, and stimulated to greater exertions. But, notwithstanding the enormously increased production, the demand has increased still more rapidly, and consequently the price has kept pace with it.

Boswell, writing for the "Public Ledger," Philadelphia, about twenty years ago, on the cultivation, preservation, and transportation of the cranberry, said: "There is ten times the quantity raised now that there was forty years ago; but instead of the price being lower than formerly, it is one hundred per cent higher. Forty years ago, in Boston, which has always been the great depot for this fruit, the price was from 75 cents to $1.00 per bushel, but for a few years past the price has ranged from $1.50 to $2.50 per bushel."

It may safely be said that, within the last ten years, the production has increased at least tenfold, and the price is now one hundred per cent higher than that named by Boswell. In fact, a portion of the crop of 1866 was sold by the growers at $10 per bushel.

This price, however, is unusually high, and was caused by a partial failure in the crop of that season; it is only mentioned to illustrate how highly the fruit is appreciated where it is best known.

Although the Cranberry is indigenous to many parts of North America, there are comparatively few localities where it has been cultivated. The most important of these are: Cape Cod, Mass., West New Jersey and Wisconsin. Other New England States, New York, Michigan, and Minnesota, have cultivated it more or less.

The first attempts at the cultivation of the Cranberry in this country, were made on Cape Cod, about the year 1820. The pioneer cultivators in that locality of course were enabled to gain considerable experience and proficiency in growing the crop long before any attention was given to this branch of fruit culture in either New Jersey or any of the Western States.

S. B. Phinney says: "Half a century has now elapsed since Captain Henry Hall, of Dennis, in the County of Barnstable, Mass., commenced the cultivation of the cranberry. His bog, or 'cranberry yard,' as he called it, has no year since failed of producing a remunerative crop. For the next thirty years after Mr. Hall commenced, many experiments were made by others, and most of them proved to be failures. The general cultivation does not date back further than the year 1850, yet since that date there have been many failures, and many bogs, recently set, will never yield remunerative crops. By this term, and by 'successful cultivation,' I mean that the crops, including the present value of the bogs, have more than repaid the original cost, interest, and incidental expenses of cultivating, picking, and sending to market."

It was not until about the year 1845 that the first vines were planted in New Jersey; and for several years the history of the Cape Cod pioneers was repeated in the numerous failures that followed. Although the Jersey-

men had heard something of the success of cranberry culture in New England, but they knew little or nothing of the methods of cultivation by which this success was achieved. Having nothing to guide them in their early attempts at cranberry culture, it is not surprising that the New Jersey growers found it unprofitable. Indeed, it is estimated that until towards the year 1860, nine-tenths of those who undertook it failed.

John Webb, of Ocean County, was perhaps one of the earliest successful experimenters in this State. He commenced by removing some sods of vines from a neighboring swamp, and placing them in a damp spot, that proved to be adapted to their growth; in this they flourished, and, in course of time, the ground was covered with vines yielding paying crops.

Barclay White, one of the first cultivators in Burlington County, writing, in 1855, to the Secretary of the Massachusetts Board of Agriculture, said: "In the spring of 1851, I commenced operations by plowing up (the turf was turned under), and planting about three-fourths of an acre on a black, peaty soil, of twelve or fifteen inches in depth, with a white sand and gravel subsoil. On either side, a few hundred yards distant, on ground in which a horse would mire, the wild vines were growing luxuriantly. I struck out the rows four feet apart each way, and planted a sod of vines, some four inches square, at each intersection. They were cultivated some that season. That fall we picked three pecks of fruit, large and fine; about an equal quantity had been destroyed by a worm, similar in appearance to the apple-worm. In 1852, I planted about one and a quarter acres in a similar manner, excepting that the hills were placed four feet by two feet apart. The product that fall was about six bushels of large fruit, picked about the last of August, but they did not keep well. The vines had become so matted as to ad-

mit of no cultivation, except hand pulling the grass and huckleberry bushes; (weeds there were none).

"No more vines were planted. From the two acres, we picked (about Sept. 7th, 1853,) fourteen bushels of sound fruit; about seven bushels rotted on the vines within two weeks previous to picking. Those picked were spread out thinly upon floors, out of the reach of frost, and decayed rapidly. I think the loss from decay in five months from the time of picking, would amount to seventy-five per cent; while of the wild berries, picked about the same time, and kept in the same manner, the loss from decay was not more than one or two per cent.

"Upon viewing the plantation in the latter part of August, 1854, I found the vines most luxuriant, matting completely over the surface of the ground. There appeared then to be about twenty-five or thirty bushels of sound fruit upon them, not quite ripe enough for picking. These soon commenced rotting, and when they were picked, about the middle of September, I secured only about ten bushels of sound fruit, which kept quite as badly as during the previous winter.

"Such has been my experience in the cultivation of the cranberry; and unless I can find a remedy for this rotting of the berry, I must abandon the business as unprofitable.

"If this can be avoided, there is an excellent opportunity here to cultivate them extensively and profitably. They begin to rot about the commencement of their ripening or coloring, on the side touching the ground, presenting the appearance of having been scalded. I have thought it might be owing to the hot sun shining on them after rain, scalding the part touching the earth. Possibly, when the vines become thicker, shading the ground more thoroughly, it may be corrected. If that is the case, I will try a new plantation, setting out the plants one foot apart each way."

There was much truth in his supposed cause of the

decay, as well as in the remedy; such were the difficulties which continually harrassed the first cultivators. They had no experience to guide their steps; no certain rules of procedure; consequently the slow progress, and frequent failures.

It was not until near the year 1860 that the cranberry business was commenced in earnest in New Jersey. Since that time it has rapidly developed, until now the value of cultivated cranberry property in this State, alone, may be estimated at several millions of dollars. In fact, Professor Cook, State Geologist for New Jersey, alluding to this production in his report of 1869, said: "Already our fields supply *more than half* of all raised in the United States." Our crop of that year being estimated at more than one hundred thousand bushels.

And yet, with these enormous results, their cultivation is principally confined to three counties, viz., Ocean, Burlington, and Atlantic, and perhaps not one two-hundredth part of the area of these is fitted for their culture.

The three counties, before named, include most of what is known as "The Pines,"—an uncultivated region, containing about twelve hundred thousand acres.

From the position it occupies, between the two great cities of the nation, it may be a marvel to some that this region should have remained so long uncultivated; but it is explained in few words. The soil is light and sandy, not suited to growing grass or the cereals, but yielding good crops when planted in small fruits. These, with the exception of cranberries, require easy and rapid facilities for marketing; such as are only obtained in the interior by the use of railroads, and those, until recently have been withheld. Hence, the swamps were left to make cedar, and the uplands to produce pine timber. But now, railroad facilities are being afforded, and large portions of "The Pines" are destined to become as a fruitful garden under the skillful management of the fruit grower.

CHAPTER III.

CHOICE OF LOCATIONS.

Every possessor of waste swamp land is interested to know whether, by planting it in cranberries, he may not "make it to blossom as the rose," and, at the same time, increase his revenue.

To every one about to engage in the cranberry business, the proper location for a meadow, as regards its soil and surroundings, is a matter of the utmost importance; for the reason, that, if a suitable soil is not selected at the start, the greatest care in preparing the ground, in setting out the vines, and in nursing them afterward, will fail to make the undertaking a success. Whereas, should a bog be chosen that is really *adapted to their growth*, some carelessness in regard to preparing and planting may follow without causing a failure.

The Cranberry is peculiar in its tastes and habits. On some soils it cannot be made to thrive, while upon others it is very hardy, and easily propagated. Indeed, we have known instances where vines, just dropped upon the surface, have taken root and grown. But skill and care are always essential in the management of a cranberry meadow, in order to obtain the best results.

We would recommend any one who contemplates investing largely in this business to visit, if convenient, some locality where it has been successfully conducted, that he may form a more correct idea of what is required, than could possibly be imparted by a description.

The *alluvial formation* is the only one in which the cranberry can be successfully cultivated. Though this formation includes the most barren and the most fertile soils, the dryest and the wettest yet its character is well marked, and it can be easily distinguished. Sand, or quartz rock,

pulverized or granulated, is *alluvium*, separated from the drift by the waves and currents of the ocean, and elevated by the action of the waters. The deltas, or rich interval lands near the outlets of rivers, are alluvium, and are formed by the subsiding of the finer particles brought down by the streams.

The mud found in the narrow bogs and creeks near the sea shore, and the muck, or peat, underlying swamps and fen-lands, are of the same character.

Salt and fresh meadows, formed partly by deposits of mud, and partly by decayed vegetable and animal matter, belong to the same class. In fact, all alluvial formations are caused by the action of water.

There are several varieties of muck, or peat, all of which have a fertilizing effect upon the cranberry vine. Muck is composed almost entirely of decayed vegetable matter, but deposits are found in different stages of decomposition; those most thoroughly decomposed being best adapted to our purpose. Professor Sidney K. Smith, of N. J., has analyzed a sample of muck, with the following results:

"The muck is spread on a plate, and placed over a vessel of boiling water—this affords a means of maintaining an equal temperature at 212° F. In this position it will lose 50 per cent ($^1|_2$) its weight of water. If you will weigh 100 parts of the sample thus dried, and burn it, and then weigh, you will have from 6 to 30 parts of ashes; so that from 70 to 94 per cent is organic matter, which took the gaseous or aeriform state as soon as heat enough was applied.

"But this difference in weight of ash comes chiefly from the larger per cent of sand, or silicates, in some varieties than in others; aside from this, since the amount of the salts of potash, soda, lime, etc., is small, compared with the whole weight of the muck, it need not be reckoned.

"It is, then, the volatile or organic part that contains

the elements of fertility which we want to render available for plant-food. This part has been found, by careful analysis, to consist of several substances, to which has been given the general name of *Geine.* Some kinds of muck contain as high as 95 per cent of geine; and in this are locked up nearly all the fertilizing substances (ammonia excepted) to be found in cow-dung. The average amount of soluble geine found in peat is estimated at 25 per cent; the more soluble it is, the greater will be its value."

The cranberry cannot be successfully cultivated in the "*Drift formation.*" Hundreds of experiments have been tried, and nearly all have proved to be failures. Professor Agassiz describes the drift formation as being that portion of the earth's surface which was formed by glacial action, and consisting of rocks not in place—that is, loose, and not in solid ledges—gravel, clay, and loam. This definition is plain, and to the point, and will enable any one locating a cranberry meadow to distinguish the drift, and reject it. Bogs, naturally well adapted to the growth of this fruit, have been ruined by using drift material in preparing them.

In some bogs where partly *drift* and partly *alluvium* were used, the exact line between the two could be traced by the difference in the growth and appearance of the vines.

Such is the testimony of S. B. Phinney, of Barnstable, Mass., and its truth is corroborated by our experience in New Jersey. It is said "there are exceptions to all general rules;" but we never knew of but one exception to the rule previously stated, that "cranberries cannot be successfully cultivated on the drift formation," and that was a small portion of a twelve-acre meadow near Medford, N. J., where the vines were flourishing upon a soil containing sufficient clay to make good moulding sand. But success in this instance was owing to the peculiar lo-

cation of the soil, it being situated on a slope which received sufficient spring-water to keep the ground always loose, or unpacked, and somewhat of the nature of quicksand. If this patch had been drained sufficiently to make the surface dry, and allow it to become packed, no doubt the vines would have failed, and perhaps perished.

Clay and loam are to be avoided, unless occurring in small quantities mixed with sand or muck; they then tend to decrease the yield and improve the quality of the fruit. Gravel is spoken of as belonging to the drift formation—this means gravel composed in part of clay, such as is used for road-making.

There is a kind of gravel, however, composed of pebbles and beach sand, belonging to the alluvial formation, which is well adapted to the growth of the vine.

There exists also a variety of yellow sand, which, at first sight, appears to contain a portion of clay; but if, upon being submitted to the test, it proves to be colored sand *only*, it may be used to good advantage in preparing the meadow.

The test for sand or gravel to be used in cranberry culture is this: Take a portion of the soil and compress it tightly in the hand; if it is suitable, it will fall apart upon being released; but if composed in part of loam, it will adhere together after the pressure is removed.

This is a simple but reliable test, and one much used by practical growers. We knew one instance of failure, where the grower had planted his vines upon a soil that strongly resembled clear, white sand, but upon examination it was found to contain a large percentage of white clay, which readily accounted for the failure.

The cranberry flourishes in pure muck, but in it the growth is frequently so vigorous as to render the vines unproductive, as well as soft and pliable, indicating a deficiency of earthy matter in the soil. As stated in a previous chapter, vines growing naturally in a swamp, are not

rooted directly in the muck bottom, but rest among the mosses above it—a twofold advantage being thus gained—for the plants are not only lifted above the water during the growing season, but they are thereby prevented from making an over abundant growth.

The soil best adapted to the production of cranberries is an *equal mixture of coarse sand and muck*, which is most certain to be obtained by covering well-decomposed muck with beach sand, the latter leaving a clean surface for the young plants; while in a few years the two become thoroughly incorporated, making, as it were, a soil of black sand. Could a soil of this composition be found in a state of nature, rightly situated as regards moisture, much expense of sanding might be saved.

Heath Ponds.

Muck is frequently found to the depth of five or six inches in *heath ponds*, or low basins,—places naturally flooded with water during winter. When the muck in these ponds is underlaid with coarse, white sand, a cheap and valuable plantation may be made by plowing to the surface two inches of the silicious subsoil, and, at the same time, turning the muck under.

Heath ponds are frequently underlaid with a very hard substratum, known as the "hard pan," which is almost impervious to water. It having acted an important part in the formation of the pond, care should be taken not to break through it while preparing for the vines, lest by so doing the surface of the ground be rendered too dry. One failure from this cause has come under our immediate observation. Figure 4 gives a section of a heath pond, showing the position of the different strata.

In selecting a location, it is very important to observe the varieties of plants or trees existing upon the ground. Although no cranberry vines may be growing there, yet

the presence of other plants, requiring similar conditions of soil and moisture, indicate a soil congenial to the growth of the cranberry. For instance, the Feather-leaf, also called Gander-bush, and Leather-leaf (*Cassandra calyculata*) (fig. 5), so abundant in heath ponds, is considered a sure indication of a proper locality.

The Ground Laurel (*Kalmia angustifolia*) thrives upon land that will produce cranberries — sometimes profitably—but such should not be chosen for a permanent meadow, it being generally too dry. Vines, planted upon these lands, become matted in a few years, produce one or two crops, and then assume a woody, or dead ap-

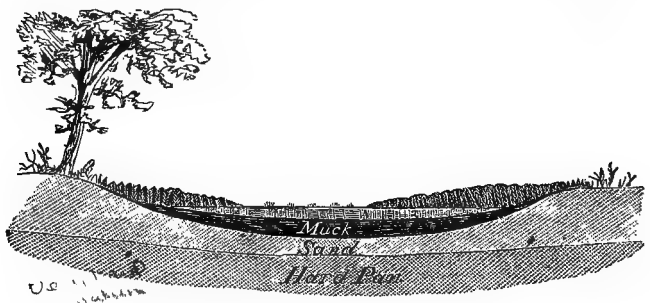

Fig. 4.—SECTION OF HEATH POND.

pearance,—and this is especially the case if they are not submerged during winter.

A soil producing the Upland Huckleberry must always be avoided, as it becomes parched or dried up in summer.

SWAMP LANDS, upon which the White Cedar, or Juniper, the Maple, Swamp Huckleberry and Magnolia thrive, are frequently selected. It is in these that the deep deposits of muck are found, and, when properly prepared, they make lasting and valuable meadows.

N. H. Bishop says: "Gum-swamp bottoms are to be avoided, as the presence of the gum-tree (*Nyssa multiflora*) denotes a cold, springy soil, which would require an

Fig. 5.—FEATHER-LEAF—CASSANDRA CALYCULATA.

expensive amount of drainage. The soil of gum-swamps seems to favor the production of more grass than any other swamp lands that we have prepared for the vines.

"It is, however, a good sign to find gum-trees in abundance, growing at the heads of streams, and all their small tributaries, as it promises an abundance of spring water that may be needed further down the valley."

For the purposes of cranberry culture, it is always essential that swamps be surrounded by sand—coarse sand,

Fig. 6.—SECTION OF SWAMP.

if possible, it being less liable to pack than that which is finer. The section, fig. 6, shows a swamp favorably situated.

SAVANNAS, or ground lying between swamps and upland, are ofttimes turned to good account, but they contain a diversity of soils, which renders their selection a matter of care.

For instance, we not unfrequently find in them heath ponds containing muck, ridges of black sand, and knolls of white sand. A Savanna is represented in section in figure 7.

The best savannas are those which contain the most heath ponds, or have a uniform surface of deep, black sand. Of the methods of preparing the various kinds of soil, we will treat in the next chapter.

Mill-Ponds have been made available by simply drawing off the water, and planting vines in their beds. Some, thus treated, have succeeded admirably, while others have failed. Joseph C. Hinchman, of Milford, N. J., owns a meadow of this character, the bottom of which consists of a mixture of sand and muck, the latter predominating. It was planted in cranberry vines in

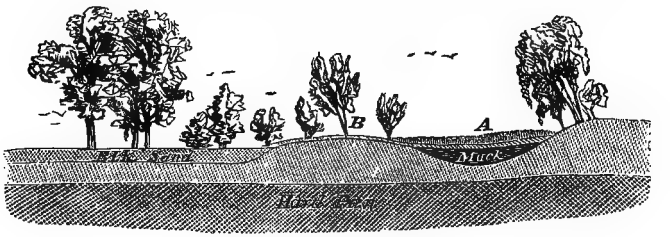

Fig. 7.—SECTION OF SAVANNA.

1865, and we are assured by the owner that its production of fruit increased every year for ten years. A portion of the surface was covered with sand, but that which was not has succeeded quite as well. In most cases, however, it will be found necessary to sand mill-pond bottoms, in order to obtain the proper conditions of soil. Hence, in selecting such locations, it is important to consider well the surroundings. Sand should be abundant, and deep; and when this is the case, the surface will look barren, and the growth upon it will be somewhat scanty; frequently consisting of pine, ground oaks, upland huckleberry bushes, etc. High banks and bold shores are desirable, on account of the spring water they afford, which, when properly controlled, becomes exceedingly valuable especially in times of drouth. (See fig. 8.)

The cranberry requires moisture always near the surface

of the soil, but it is necessary that it circulate freely through the ground; as *stagnant water is fatal* to the growth of the plant. Therefore, in choosing a location, though everything else may be favorable, if you cannot drain the ground *at least one foot* below the surface, reject it at once. This drainage is required to enable the water to pass readily through the soil, and avoid anything like stagnation.

On true "Cranberry ground," although the ditches may be cut one or two feet deep, the soil rarely becomes *dry*

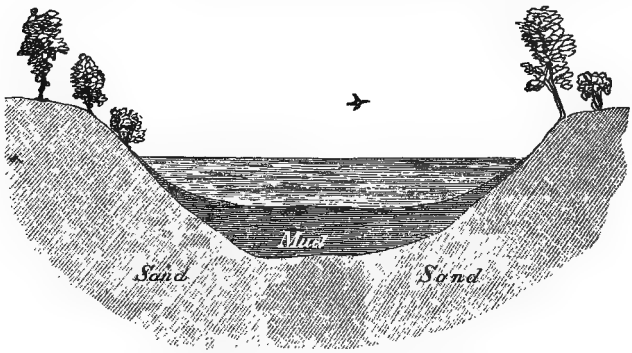

Fig. 8.—SECTION OF MILL-POND.

more than half an inch below the surface, and this is as it should be. Water is essential, but *it must be under control.*

Small living streams are quite valuable for the purposes of winter flooding and summer irrigation; hence, they should be duly considered in selecting the location.

UPLANDS are always to be avoided, whether of alluvial or drift formation, the objections to them being numerous; for instance, the vines upon dry lands are short lived, blossoms are blasted, and the fruit is dwarfed or badly worm eaten, the ravages of the *fruit worm* being greatest upon dry soils; of the fruit worm we will speak more fully in the chapter devoted to "Enemies and Difficulties."

Portions of some cranberry meadows are impregnated with oxide of iron, and where this occurs, the soil has a tendency to form long, perpendicular crystals of ice in winter, which lift the roots of the vines entirely out of the ground.

These places are objectionable; for, although the heaving may be prevented by continued flooding in cold weather, it is quite common to have the water accidentally drained off, thus requiring young vines to be replanted, and seriously injuring those more matured.

Pure muck, also, has the same objection; it will heave the young vines out during the process of freezing and thawing, unless covered with water or sand. Hence another advantage of sanding such bottoms; even one or two inches being sufficient to keep the plants rooted.

Coarse or flakey mucks are not good to retain moisture, neither do they absorb it from below in dry times; consequently, without irrigation, soils of this character suffer more from drouth than sand itself. They also have a tendency to crack open in summer (unless covered with sand), much to the injury of plants growing upon them.

CHAPTER

PREPARING THE GROUND.

Having selected a location, combining water, sand, and muck, in proper proportions, the next step is to prepare the ground for planting vines. And as the *modus operandi* is varied for the several locations, swamps, savannas, and mill-ponds, we will describe the manner of preparing each separately.

Swamps.

Should a swamp be the chosen spot, the first step will be to cut a main ditch, to the depth of two feet below the surface of the muck underlying the turf and roots, and of sufficient width to prevent the surface becoming flooded after heavy rains. This drainage will enable the remainder of the work to be done more expeditiously, and, consequently, more cheaply. Next, remove the bushes or brush from the ground, to make room for the turfing-hoe. This may be done to best advantage in summer, while they are in full leaf, at which time the bushes should be cut down with a brier-scythe, axe, or bill-hook, and left

Fig. 9.—BILL-HOOK.

until the leaves are entirely dry. Figure 9 shows a bill-hook designed by James A. Fenwick, and is superior to the one in general use, the thick, heavy end rendering the cutting edge more effective.

While the leaves are thus drying, the edges of the swamp should be turfed one or two rods in width to prevent the escape of fire, after which, with sufficient force for any emergency, the torch may be applied to the leeward, and the devouring element will not only consume the brush, but also a large portion of the dry turf in the bottom, thus causing the remainder to be more easily handled, and making the swamp present a much less formidable appearance than before.

After disposing of the bushes, the ground is to be "turfed," or "scalped," as it is sometimes called, that is, the turf and surface roots must be separated from the soil beneath, and turned over in pieces twelve or fourteen inches square, or of convenient size for taking off. A

turfing-hoe is used for this purpose, made of plate-steel, about six inches wide, and ten inches long. Before using the hoe, however, the dexterous workman cuts his turf in strips, twelve inches wide, with a cleaver or ax. (See fig. 10.) The average cost of turfing is now twenty-five cents per square rod, or $40 per acre. The next step, after loosening the turf, is to remove it; and to accomplish this, the "floats" may be conveyed to the shore, either on barrows or railroad cars, and used in constructing the

Fig. 10.—CUTTING AND PARING TURF.

surrounding fence. Twenty-five cents per square rod is the price usually paid for "hauling off" the turf and building the fence, or wall.

After freeing the ground from turf, the stumps should be cut off even with the surface, upon those portions of the meadow which are to be sanded, and removed entirely from those parts where the sand may be plowed up from beneath.

Some of our successful growers consider it a waste of time and money to take up stumps, saying "the vines

will run over them in course of time," which is very true, but the vines will not root in them unless their tops are very much decayed; and whatever prevents the runners from rooting, is an injury to the meadow, whether it be moss, surface roots, or stumps. But were there no other advantage to be gained, the satisfaction of having one's ground free from such eye-sores is worth the price of removing them, especially after the meadow becomes worth $1,000 per acre, as many in this State now are. Should there be any live roots remaining near the surface —for instance, huckleberry or brier roots—they may be loosened with a grubbing-hoe, or large iron-toothed rake, and removed on wheel-barrows.

Having disposed of the stumps and roots, we have now a clear surface of muck, with perhaps only one or two main

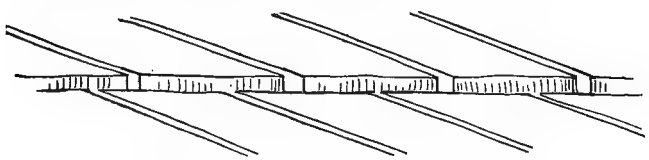

Fig. 11.—MAIN AND SIDE DRAINS.

ditches cut through it; but these would be very insufficient for thoroughly draining a large or wet swamp; and in consideration of which side drains (fig. 11) must be dug of sufficient number and capacity to drain all parts of the meadow at least one foot, or, better, eighteen inches below the surface.

In many swamp bottoms it will be found necessary to cut these branch drains two rods apart throughout the entire length of the meadow; their number, however, must depend upon the dampness of the ground, quantity of water to be carried off, etc. It will also be found necessary, at times, to dig good deep ditches along the edges, to regulate the spring water. The earth removed from the ditches, which will, of course, be composed of muck, must

be spread over the surface of the meadow, or removed to the upland, and then we are ready for the sand. This is generally taken from the edges of the swamp upon barrows and plank walks, where the swamp is narrow, and upon cars where the surface to be covered is extensive. The car track (fig. 12) is movable, and is made in sections, each of which consists of two 4×4-inch pieces, fourteen feet long, securely fastened together, and bound with strips of iron one-fourth of an inch in thickness, to serve as "rails." In

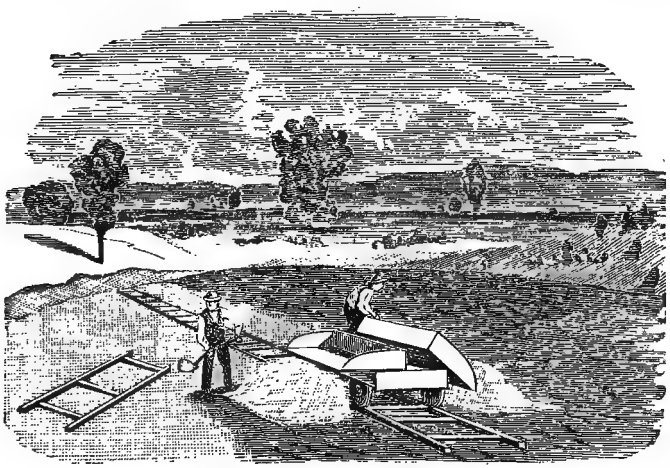

Fig. 12.—SANDING A MEADOW.

most cases, it will be found advantageous to place wide boards under the ends of the sections where they come in contact, to prevent them from settling in the muck. The track is laid from the shore to any given point in the meadow, and one, or perhaps two, light dump cars placed thereon. If two, they are loaded simultaneously at the shore with clean sand, free from all roots or loam, and pushed out by the men to the required spot, where the sand is dumped on either side of the track, and spread evenly over the muck. This operation is repeated until

the surface is covered on both sides of the track, when the railroad is moved to another place, and sand leveled over the place where it rested.

It requires some judgment to determine the proper depth for the sand, which will vary according to the quantity of muck, and character of the bottom—most sand being required on those meadows containing the deepest muck, for the reason that an inch or two only, upon a deep, soft bed of muck, would settle down, and be lost in the black mass beneath. Therefore, where the muck is six or eight feet deep, let sand be put on to the depth of five or six inches; but where it is only a foot or two thick, two or three inches of sand will be sufficient. The price for sanding will vary with the width of the meadow and the quantity put on—ranging from $50 to $150 per acre, for putting it on from one to four inches in depth.

Another method of disposing of the turf and sanding meadows was adopted, a year or two since, by John Pointsett, the energetic manager of affairs at "Cranberry Park." His method is, in some respects, superior to that just described.

After turfing the ground, he had the floats thrown up in windrows, leaving a cleared space of about two rods in width between them. He then dug pits, where the muck was not more than two feet thick, and threw out the clean, white sand from beneath, after which the track was laid, and the sand carried out and spread over the surface, while the turf was brought back, on the return trips, and packed in the pits.

When the excavations were nearly filled up with debris, the muck which had previously been removed to uncover the sand was thrown back, leveled, and covered like the remainder, so that one could not tell where the holes had been by any unevenness in the surface. It is essential, in

this method, that the turf be *packed* in the pits as tightly as possible, to guard against settling.

Sand from beneath muck is free from seeds of weeds, etc. The line could be traced between the sand from below, and that from along the shore by the growth of weeds upon the latter.

Mr. Poinsetts' plan is less expensive, since neither sand nor turf is to be carried so far. One hundred dollars per acre were paid for removing the turf and spreading on sand two inches in thickness. When the turf is thus disposed of, a surrounding wooden fence must be built.

The summer months are most favorable for preparing cranberry ground; since as there is but little water to interfere at that time, the work may be pushed forward rapidly. From the 1st of December to the 25th of March bog work cannot usually be performed economically, on account of the frost and water which prevail at that season, impeding the progress of the workmen.

The present plan of clearing swamps is, to cut down the trees and bushes, build a dam, and flood for two years. This so destroys the vegetation that the vines may frequently be planted at once.

Heath Ponds.

Heath ponds are prepared in much the same manner as swamps. The necessary ditches are first cut, the ground is then turfed, and the turf removed. If the sand underlying the muck is within reach of the plow, the bottom will be comparatively firm, and the turf may be "hauled off" to good advantage with a pair of horses, attached to an ordinary farm wagon; and the proper soil for the berries may be obtained by bringing to the surface, with a plow, an inch or two of the white subsoil.

When the muck is a little too deep to enable the plow to work the sand up, a system of trenching may be resorted to, as shown in fig. 13. Let the turf be thrown up

in the form of windrows by pitching it one rod each way, thus clearing a space two rods in width; then cut a ditch near the row of turf, and throw the muck on the side next the turf, and the sand on the cleared surface, where it is to be spread about, as at A, fig. 13.

After the sand is thrown out, the ditch should be packed nearly full of turf, the muck leveled over it, and the whole carefully covered with sand, as at B, fig. 13. Enough ditches must be left open to thoroughly drain the meadow.

Perhaps there will be a surplus of turf after filling the ditches, if so, remove it with the car and track, or wheel-

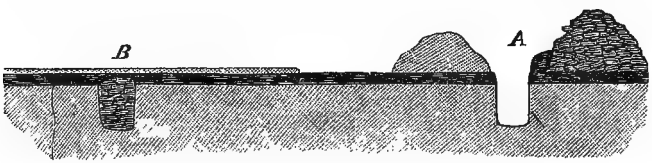

Fig. 13.—TRENCHING FOR SAND.

barrow and planks. Wheels should never come in contact with the surface after sanding, for the obvious reason that they would press the sand out of sight.

When the muck in the heath pond is very deep, the sand must be brought from the edges, as described for swamps.

In clearing cranberry ground, the turf is always to be removed, excepting where it consists of grass only, growing as it frequently does, upon some deep muck bed, or old swamp bottom whose sturdier growth has been consumed by fire in past ages, only leaving the imbedded logs and stumps to remind us of its former existence. These locations may be cheaply prepared by bending the grass down, and covering it with six inches of sand. If this is done in midsummer, while it is growing freely, the grass will be totally destroyed, and the expense of "turfing" and "hauling off" be saved. Care should be taken, however, before sanding, to remove all fern roots and bushes,

otherwise they will grow up, and be a continual source of annoyance.

The cost of clearing and sanding swamps and heath ponds for cranberries varies from $175 to $600 per acre, depending upon the size and roughness of the bog, depth of sand, etc.

Savannas.

This term is given to the medium lands, so to speak, being midway between swamps and uplands. Their surfaces are more or less undulating, and the character of their soil quite varied. The knolls or higher portions, having been

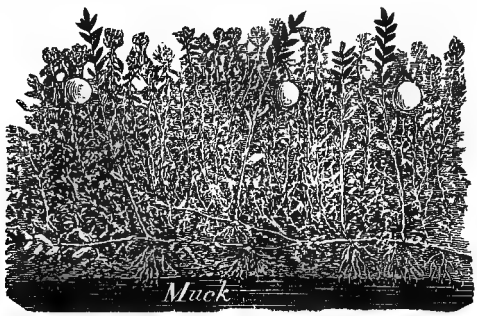

Fig. 14.—SPHAGNUM MOSS AND CRANBERRIES.

leached by the rains, are deficient in vegetable matter, while in the basins or lower parts, the accumulation of water and wash from the knolls has gradually assisted in the formation of a muck deposit, supporting a rank growth of Sphagnum and Feather-leaf.

The plant producing muck most rapidly is the *sphagnum moss;* growing luxuriantly in boggy or wet places, it possesses the property of increasing at the top, while at the same time its lower extremities are decaying and blending with the dark soil below. The nourishment for the plant is derived principally from the air and water.

As in clearing swamps, savannas must first be ditched

and then turfed. For cutting the turf in strips to prepare it for the hoe, an ordinary cleaver may be used; or, to accomplish the work more expeditiously, use a tool (fig. 15) made in the following manner; viz: fix a stout, sharp coulter in a beam, with handles and clevis attached; and let it be drawn through the turf by a horse, the length of the blade being properly adjusted to cut to the required depth.

Some prefer the coulter to incline backward, that it may slide over large roots, but when in that position, the tendency is to raise out, and it requires considerable pressure to keep it to its work.

In order to dispose of the turf after being separated from the soil, we have sometimes heaped up and burned

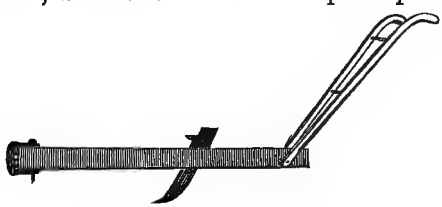

Fig. 15.—TURF CUTTER.

that grown on the lower portions of the meadow; on the higher parts, the turf generally contains too much sand to burn freely. The ground may be cleared more cheaply in this way, but the effect of ashes upon the soil is to produce a growth of Tree-moss (*Polytrichum commune*), which, when abundant, is a serious injury to the vines, in that it keeps the runners lifted above the ground, and prevents them from rooting. Upon spots where heaps of turf have been burned, moss frequently comes in, even after plowing; but if the ashes are spread on the surface, and plowed under, no injury will result from them.

Ashes have also a fertilizing effect upon the cranberry vines; this fact induced us to spread them, several years ago, upon the surface of a sandy knoll, where the vines

were not thriving, but the damage resulting from the growth of moss overbalanced any benefit derived from the ashes.

The "Pines" of New Jersey are subject to devastating fires, which sweep through them during the drouths of summer, doing an immense amount of injury to growing timber, and frequently jeopardizing the turf fences which surround the numerous cranberry meadows in that region.

When the fire is once in a turf fence, it is almost impossible to extinguish it, the only remedy being to cut a wide gap in the fence, to save that which is not on fire, and let the burning portion gradually smoulder away.

A portion of the fence surrounding Howard White's fifteen-acre meadow, near New Lisbon, took fire in August, 1869, and continued burning for two months, although a number of heavy storms occurred during that time.

Fires in the "Pines" often originate from "coalings," or are started by men desiring a winter's job at chopping the dead timber. As the smoke looms up, it is seen by some one in the country who recognizes it as being in the direction of his "tract," and hastens to the spot, where, with the assistance of the inhabitants, he endeavors to impede its progress by firing against it, or by throwing sand. When a native of the pine region starts out to "fight fire," he as naturally takes with him his shovel and matches as the city fireman does his hose-carriage or engine. The extinguishing effect of sand, when thrown upon the flames, is quite equal to that of water.

These fires sometimes burn with sufficient fury to consume all the turf on portions of savannas over which they pass; and where this is the case, the moss starts up very luxuriantly. As a general rule, in clearing savannas, it is best not to burn the turf upon the ground, but to cart it off, and build with it a fence around the meadow.

A turf fence, when properly constructed, bears some resemblance to a "dry wall" of stone. In order to build

one, first ascertain where it is to be put, then mark the inner line of the fence with numerous stakes, after which decide upon its width, or thickness, which will vary according to the quantity of turf to be used up—from four to six feet—the average height being from five to eight feet. Having determined the width, set up another row of stakes parallel with the first, to indicate the outer line, and then build the wall up perpendicularly between the two. Care should be taken to keep the top of the fence

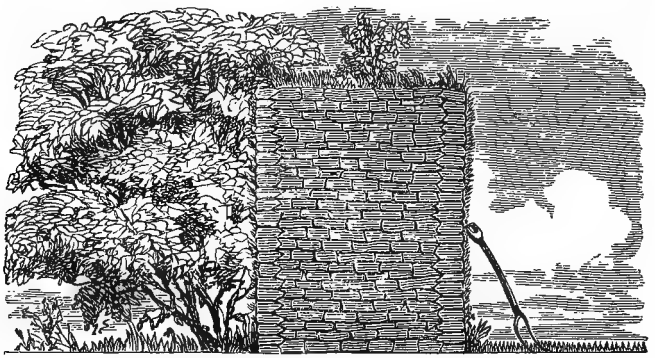

Fig. 16.—SECTION OF A TURF FENCE.

level, and to *bind on the outer tier* of floats by lapping the second row a little over them; this will make the structure firm and durable. (See fig. 16.)

The *fork* that we have found most convenient for handling turf is one made from an ordinary two-tined hay-fork, by simply cutting off the tines to about eight inches in length, bending them to the proper shape, and securing them in a manure-fork handle. (See fig. 16.) This handle is very efficient in placing the turf on the wall, it being quite an improvement upon the straight one so frequently used.

While the fences are being built, it is best to make arrangements for flooding the meadow, as it may require a different arrangement of walls to protect the dam. (See

chapter on Flooding.) Having disposed of the turf, the next step is to take out all sound stumps and live roots, as described for clearing swamps, after which the surface may need some leveling; for instance, a pond, A, fig. 7, containing muck may be in proximity to a ridge, B, of sterile sand; if so, the knoll must be cut down, and the sand used for covering the muck; this will make the genral surface more level, and require less water to flood it. It will be quite important, however, to return some of the muck to the poor soil on the ridge, where it should be thickly spread about, and plowed under.

But if the deposit of muck in the pond is not deep enough to require sanding, in most cases it will not pay to level the ground, for the reason that the sand, if spread too thickly in the pond, would injure it, and the knoll from whence the sand was taken be left too poor to produce fruit.

In all these operations good judgment and skill are required to bring the meadow into the best possible condition for the vines.

In some instances, clay or loam is found underlying a thin stratum of muck. Where this occurs, the subsoil should not be brought to the surface; but if sand is not convenient for covering it, plant the vines upon the cleanly raked surface of the muck without plowing. When this is done, the meadow must be flooded in winter to prevent heaving.

We recently visited a savanna where the vines had been planted upon an inch or two of muck; they were exposed to the weather, and were badly thrown out by the action of frost. When only a thin covering of muck rests upon a bed of sand, it is best either not to plow at all, or very slightly, turning up only an inch of the sand.

After plowing savannas, it is necessary to give the ground a thorough harrowing, to level any irregularities

that may exist, and also to loosen the roots and bring them to the surface.

Some growers think it best to leave the roots upon the surface, saying, "when they decay, the soil will be increased in fertility." But we cannot afford to use such expensive fertilizers as roots and sticks, for the reason that, if they are left in the soil, some of them will grow:

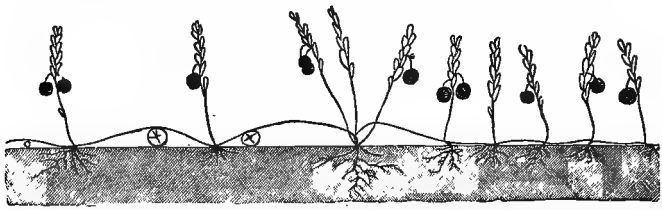

Fig. 17.—PLANTS ON CLEAN AND ROOTY SURFACES.

and if upon the top, they will seriously interfere with the matting vines by keeping the runners from rooting. Figure 17 illustrates the difference between a rooty surface and one made perfectly clean.

Savannas, with sand within reach of the plow, may be very cheaply prepared by throwing the turf, one rod each way, into windrows, and planting vines upon the cleared ground between them. (See fig. 18.)

The wash from the decaying turf is found to act as a good fertilizer, and the embankments serve as a protec-

Fig. 18.—PLANTING IN STRIPS.

tion against the blasts of winter, in situations not susceptible of being flooded.

MILL-PONDS.

Success in cultivating the cranberry on mill-pond bottoms depends, perhaps, more upon the location than upon

the manner of preparing the ground. But, however favorable the location, if the bottom is not completely drained and well managed, it will fail to produce good results. One great source of failure is imperfect drainage.

Mill-pond bottoms require no turfing; the standing water having destroyed the growth of bushes, etc., since none but aquatic plants can exist when entirely submerged.

If the soil is about an equal mixture of sand and muck, no extra sand will be required; but should the bottom consist of muck alone, it must be covered, and to accomplish this, several methods have been adopted; for instance, the swamp may be flooded, and the sand taken out upon rafts and thrown into the water, stakes being used to mark where it is deposited. Or, it may be spread evenly over the surface of the ice in winter, and, when the ice thaws the bottom will be well sanded.

Railroad cars and tracks are used to advantage in covering extensive tracts; but the cheapest and most expeditious method that has come to our notice was one adopted by Jos. C. Hinchman, the practicability of which he proved by thoroughly covering with sand a mill-pond, containing eighty acres, in a few weeks, with the assistance of two or three men.

Water was the vehicle used to carry the sand, and to utilize it the stream was dammed near the head of the swamp, which caused the water to flow in raceways constructed upon each side of the meadow. He then commenced at the lower end; and, by turning all the water into one channel, succeeded in washing away high knolls, or banks, and depositing the sand evenly over the surface of the meadow. The secret of success seemed to lie in keeping the channel in form—like the arc of a circle—at the place where the washing was going on, and to do this was the principal work of his assistants.

The banks of this mill-pond contained more or less clay in combination with the sand, and, had they been

spread over the surface in the usual way, the probabilities are that the undertaking would have resulted in failure. But during the process of sanding with the aid of water, the clay was washed out and carried down stream, giving the water an ochreous hue for several miles below, thus leaving the sand in good condition for the vines.

CHAPTER V.

PLANTING THE VINES.

The surface of the meadow being thoroughly prepared, the question arises, When, and how, shall I set out the vines?

We know of no particular time, better than all others, for planting the vines; but in spring, from the first of April to the first of June, is the proper season in New Jersey. They may be put out even later than this in the New England States. It is considered here that vines, set out after the first of June, are but little better than those planted the following spring. The cranberry vine is exceedingly hardy, and will live, in its proper soil, under treatment that would be fatal to almost any other plant. We have seen vines live, transplanted even in June while in blossom, and in July with berries on them.

Indeed, some growers being late in making their ground ready, have put out many acres of vines during these months; but, in most cases, it is very unwise to do so, since more or less of the plants will perish from exposure to the scorching suns of midsummer, or from being put on ground deficient in moisture, while those surviving make little or no growth until the next year.

Fall planting is recommended by some, but this season of the year is no better than early spring. Those, however, having more ground prepared than they can put out properly in the spring, will do well to plant the higher portions of the meadow in autumn, being careful to avoid any low places containing clear muck, the freezing and thawing of which would heave out the young vines.

The *best mode* of planting cranberry vines is a point upon which "doctors disagree;" therefore, to enable each one to select for himself, we will describe the various methods in use, and call attention to those which have answered us best.

1st. Sod Planting consisted in taking, from their native marshes, sods containing cranberry vines, moss, turf, etc., and depositing them at regular or irregular distances upon the prepared or unprepared meadow, as the case might be. If the meadow was prepared, holes were made to receive the sods; if not, they were simply thrown upon the surface, among the grass, etc., and left to take their chances. This was one of the earliest plans, originating, perhaps, from a desire not to disturb the roots of the plant; but there being many and serious objections to this method, it has long since been discarded.

2d. Hill Planting was an improvement upon the sod system in one respect; viz., bunches of *clean vines* were used, free from the roots of other plants. The ground was marked out in drills about two feet apart each way, and a handful of vines planted at each intersection; but large bunches of vines have a tendency to dry up and become woody, thus seriously injuring the plantation. This difficulty induced some cultivators to adopt the expedient of planting in funnel-shaped holes, made by rotating a sharp stick or dibble; the vines are placed in these holes, and scattered around so that, when the center is filled with sand, they will be spread out, pointing in all

directions (see fig. 19); dead bunches are thus avoided; but this plan is not generally adopted, it being more expensive and less satisfactory than some others.

3d. PLANTING IN DRILLS.—Upon all soils which require no sanding, but are susceptible of being prepared with

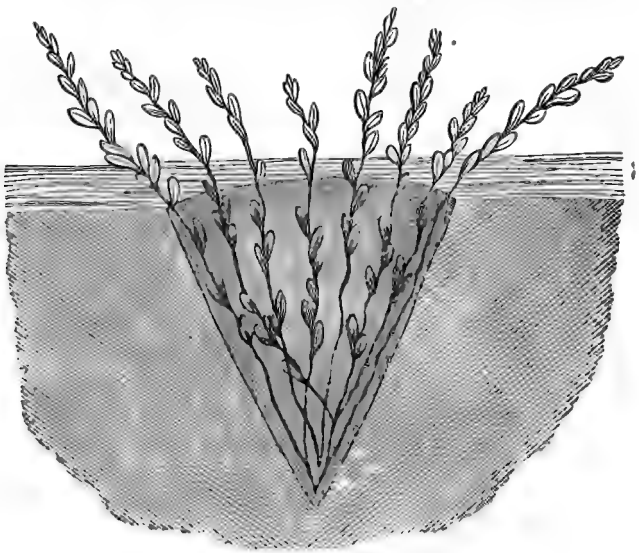

Fig. 19.—PLANTING IN HILLS.

the plow, the *best* method is to "strike out" the ground with a plow in rows, three feet apart, and scatter the vines thinly, but evenly, along the furrow, putting only one or two in a place. They should be leaned up against the "land side," projecting four or five inches above the surface, after which the hoe is required to fill up the furrow, and thoroughly cover the roots. (See fig. 20.) Care should be taken to pull a portion of sand upon the vines, in order to bend them down upon the surface, as shown in fig. 21.

This causes them to sucker up and grow more luxuri-

antly than when left standing upright, to be swayed by the winds.

The labor of planting vines is generally performed by women; one, taking a bundle under her arm, drops the

Fig. 20.—PLANTING IN DRILLS.

vines in the drills, while another follows after her with a hoe. The average price paid the women is 75 cents each per day; the whole cost of making the furrows, dropping and covering the vines, amounts to about $8 per acre.

In striking out cranberry ground with a plow, it is im-

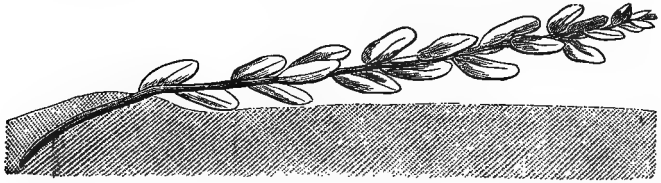

Fig. 21.—PROPER POSITION OF VINES.

portant to have the land sides of the furrow as nearly as possible the same way; and this may be done by going down one side of the meadow and up the other, or by

striking it out in "lands," letting the plow run out at the ends. The object in doing this is to obtain a uniform distance between the rows.

If the furrows were made in the same manner as for corn or potatoes, and the vines dropped on the land side, the work, when finished, would look very irregular, pre-

Fig. 22.—INCORRECTLY PLANTED.

senting an appearance somewhat like that represented in fig. 22. When correctly planted, the vines appear as in fig. 23.

The quantity of vines required to plant an acre is ten barrels, the cost at present being $3 per barrel. If sent to a distance, the expense of freight and barrels would be additional. Upon soils disposed to become foul with grass, more vines are necessary, because they have the weeds and grass to contend with; and the greater their numbers, the more complete will be their victory.

But if more than ten barrels per acre are needed, they should be put on by diminishing the distance between

Fig. 23.—CORRECTLY PLANTED.

the rows, and not by increasing the number of vines in a place, as the plants die if crowded. It is best, in most cases, to use a *moderate* supply of vines for planting; they then form a new and even mat over the ground.

When they are placed in rows, although the intermediate spaces may become entirely matted, the rows will remain visible, and serve as valuable guides to the pickers, each one taking the space between two of them.

4th. PLANTING BY PRESSURE is, perhaps, the best mode of putting out vines upon all soils, prepared by spreading

sand over muck. This is accomplished by first marking out the ground, fourteen inches apart, with a small sled, having three runners; the vines are then dropped on these marks, about two in a place, and fourteen inches apart, and pressed into the ground with a spade-like tool, placed on the vines about one-fourth the distance from root to top. We have used a forked stick for the same purpose; but the blade is an improvement, it being more easily forced into the soil, and when removed, it leaves no hole around the plants to dry their roots. It is important that the vines should be pressed in at an inclination, thus

Fig. 24.—PLANTING BY PRESSURE.

bringing the tops near the ground, and causing them to sucker up better than when pressed down perpendicularly, for the reason previously given in drill planting. Figure 24 shows this manner of planting. The roots of the vines should be brought into close proximity with the muck below, that they may be stimulated to grow more rapidly. Women may be allowed to drop vines in this way, but they should never be chosen for pressing them into the ground. As a leaning posture is required, their skirts have a tendency to drag the vines out of place and waste them.

COVERING THE VINES WITH SAND was tried, a few years since, by Theodore Budd, an enterprising cranberry

grower, of Burlington Co., New Jersey. He first spread the vines evenly over the surface of the meadow, and then entirely covered them with sand—putting it on about one inch thick. The young shoots came up through this covering as thick as wheat, and made an excellent growth, quickly matting the whole surface. This method requires more vines than the two last named, but by adopting it, a crop will be produced sooner than by planting in any other way.

The vines must not be spread far ahead of the men who are covering them, lest they be injured by the sun and wind, although they will endure as much exposure as most hardy plants.

Sowing Cuttings may be done successfully, a fact which goes far toward establishing a reputation of hardiness for the cranberry vine. The vines are passed through a straw-cutter, and chopped in pieces about one inch long; they are then sown like oats, upon an evenly prepared surface, and harrowed in. It is essential that this be done very early in the spring, and upon moist land, so as to enable the cuttings to become well rooted before the heats of summer. A patch put out in this way may be seen on the grounds of Shinn & Allston, near Turkeytown, N. J., in a thriving condition, but this system is not recommended for general culture.

Great care should be taken, in selecting the vines, to procure those which yield large berries; the shape of the fruit is of little consequence; the great desideratum being, as previously stated, to obtain berries of *good size* and *color*.

As it is impossible to judge from the appearance of a cranberry vine what shape or size its fruit will be, it is best either to become acquainted with the quality of the vines before using them, or to purchase them of reliable parties. Even with these precautions it would be difficult to obtain a large lot of vines, producing berries of a

uniform shape or size; but a *good class* of vines may be supplied in large quantities from many well established cultivated meadows in New Jersey.

More care is needed among cultivators of the cranberry in propagating valuable varieties. There is no reason why we should not have a "Triumph of America," or an "Early Wilson" among cranberries as well as among strawberries or blackberries. Large red cranberries are certainly the most valued in the city markets, and by planting this variety only, upon our meadows, the profits might be increased.

But it must be admitted by all, that successful cranberry culture depends not so much upon the variety of vines as upon the *soil* in which they are planted, and the *management* afterward.

Attempts have been made to grow them from the seed; but owing to the longer time required for the vines to become profitable, and the increased expense of keeping them clean, this system has been abandoned for general culture.

New seedling varieties may be obtained by planting the seeds, near the surface, in a soil composed of three parts sand and one part muck. This should be in a warm situation, and kept always slightly moist while the plants are young.

CHAPTER VI.

MANAGEMENT OF MEADOWS.

After the vines are properly set out, the next consideration is to get them matted over the ground as quickly as possible, in order that they may yield a full crop, and reward the grower for the labor and care bestowed upon them. Indeed, it is no uncommon thing for the first *full*

crop of cranberries to pay for all the expense of purchasing, preparing, and setting out the land.

But, until the vines are matted, one very important rule must be observed, viz: *Keep the meadow thoroughly drained*, at least one foot below the surface. It will generally be found necessary to go deeper than that to effect a *thorough drainage*, without which the vines will not thrive, even if planted on ground well adapted to their growth. By allowing the meadow to remain very wet, the vines may be almost prevented from growing at all.

When properly drained, a good meadow will become matted in three years, although some of the most permanent plantations have required a longer time to come into full bearing, owing to the dampness of the soil.

For two or three years after putting out the vines, it is best to keep the ground free from grass and weeds, that the plants may have undisputed possession. During the first year a hoe may be used; but afterward, the grass must be pulled by hand, or taken out with a trowel, to avoid loosening the runners which are rooted in the soil. This weeding by hand, may sound like a very formidable undertaking, but generally it is not, since the turf has been all removed, and poor sand is not very encouraging to the development of plant life. It should be done in August, before the weeds go to seed.

For two years past, it has cost only $2.50 an acre per annum, to clean "our 20-acre meadow," and next season the expense will not be so great, as the vines are becoming well matted over the ground.

Some growers assert that it is not necessary to dig up rushes, claiming that the vines will, in time, root them out, provided they are mowed off every season, to prevent the formation of seeds.

Experience has taught us that it does not *pay* to remove the "Double-seeded Millet" from newly prepared bogs. This (fig. 25) is an annual, producing seed under ground

Fig. 25.—DOUBLE-SEEDED MILLET.—(*Amphicarpum Purshii.*)

as well as above. It makes its appearance on savannas and heath ponds directly after the ground is broken, although, perhaps, not a specimen was visible before. During the first year its growth is vigorous, and somewhat alarming; the next, it comes up from the seeds again, but does not grow so luxuriantly; and the third season, although the seeds germinate, the plants have a sickly, yellow appearance, and most of them fail to perfect their fruit; after this they almost entirely disappear.

In alluding to cranberry meadows, Dr. J. Gibbons Hunt, a well-known naturalist of Philadelphia, says: "A very curious grass comes up in these bogs after the turf has been removed. It has tufted, flat, lanceolate leaves, clothed with bristly hairs. It flowers both above and under the ground. Botanists call it Millet-grass, or *Amphicarpum Purshii*. The aerial flower is borne on a loose branching panicle, with fruit rarely ripening. Below the soil subterranean peduncles branch off from the roots, bearing on their ends perfect, solitary flowers, which are followed by mature fruit. Thus a double life seems to be given to this humble grass, and, for a weary time, like Patience herself, it has been waiting and flowering beneath the turf, planting its unseen and unsunned seeds." Another species of *Amphicarpum* has been discovered in Florida on the banks of the Apalachicola River by Doctor Chapman, who named it *Amphicarpum Floridanum*. It has similar subterranean flowers, and is a more robust plant, with a more creeping habit than the northern species.

The millet does but little injury to the vines, as it gradually decreases as they increase and have need for the ground. Large sums of money, perhaps thousands of dollars, have been unnecessarily expended in removing this grass from cranberry meadows.

Mill-pond bottoms sometimes become very grassy after the cranberry vines are planted, yielding, occasionally, a ton of hay per acre, and presenting an appearance rather

discouraging to the novice; he should not despair if the vines are on a situation adapted to them; the grass may be overcome without hand pulling, by simply mowing it off in summer, to prevent its going to seed, and then keeping the water up late in the spring—say until about the first of June.

This late flooding is quite destructive to the grass, without being injurious to the young vines, which start off vigorously when the pond is drained, and make good use of the advantage they have gained.

Joseph Hinchman succeeded in subduing the grass upon his most valuable meadow by summer mowing and late spring flooding.

Thorough drainage is required to obtain a growth of vines; but after the mat is completed, there are certain times when considerable moisture is necessary to insure a good crop; for instance, during a season like that of 1869, when a drouth, occurring in June, blasted fifty per cent of the blossoms upon most plantations; on meadows naturally moist, and on those which were irrigated by raising the water in numerous ditches, the loss was much less. Again, there are other advantages in having a moist surface (not surface water), while the fruit is growing; viz: it causes the late formed berries, of which there are always more or less, to grow up to the full size, when, without moisture, they would come to naught; and it also checks the ravages of the fruit worm.

But where irrigation is resorted to, care must be taken to lower the water in the ditches by the middle of August, that the vines may be enabled to make a good fall growth. If this is not done, the crop of the coming year may be seriously damaged. The fruit-buds are formed in the fall, and are visible at the ends of the new growth on the upright branches.

The Management or Improvement of Natural Bogs is worthy of our consideration. James A. Fenwick,

one of the most successful operators upon natural bogs in New Jersey, says: "They must be drained gradually and carefully at first, to enable the vines to settle by degrees, and become well established upon a firm foundation."

As before stated, cranberry vines, in their normal condition, frequently grow among sphagnum moss, some distance above the solid muck; and when this moss is suddenly made dry by ditching, the vines are liable to perish before they become rooted in the muck. Hence the necessity of draining carefully at first, although, in time, the bog may be *completely drained.*

Where sand is accessible, under a natural meadow, the vines may be greatly improved by digging trenches two rods apart, and spreading the sand among the grass and vines. Even muck, taken from trenches where sand could not be reached, and spread over the surface, has benefited vines growing on muck bottoms. J. A. Fenwick states that, from $100 spent in trenching and sanding natural vines, he was benefited to the amount of $1,000.

Natural meadows require flooding every winter as well as those under cultivation.

Fertilizers.

Many attempts have been made to increase the growth of the cranberry vine by using fertilizers; but, as yet, nothing has been found so good, in all respects, as swamp muck.

All the necessary elements, excepting those obtained from air and water, are contained in sand and muck, and, as previously stated, the proper soil is a mixture of the two. If muck is in excess, it should be diluted with sand; and if sand is overabundant, it may be enriched with muck. Even after the vines have been planted upon poor soil, a top-dressing of muck will greatly improve them.

Peruvian guano causes a wonderful growth of vines, and, in some cases, might prove beneficial if applied with care, but little guano being required.

Ashes, provided they are spread on the ground before plowing, may be profitably used where muck is deficient.

Lime, *marl*, and *stable manure* might improve the vines, but, since they have a tendency to bring in weeds and grass, we would not recommend their use.

Mud deposits, formed by the washing of rich uplands, are so productive of grass, etc., that successful cranberry culture upon them would be exceedingly uncertain, such is the character of many of our river marshes and meadows, subject to tidal influence; and it is very doubtful whether sufficient drainage to grow cranberries could be obtained by diking, ditching, and building sluice gates, as is done in reclaiming grass lands.

Flooding might be resorted to under such circumstances for subduing the grass, but these situations are not considered desirable, and the chances of success would not warrant one in spending large sums of money upon them without first testing the ground in a small way.

Unlike most other agricultural productions, cranberry vines, growing upon land adapted to them, require no expenditures for manure or tilling to keep them in good condition. When once established, they will last for years, yielding good returns as regularly as ordinary farm crops.

These facts, in connection with the high price of the fruit, render cranberry culture a most remunerative business.

It requires a very considerable expenditure of labor and money to start the business, and after that, much patience to reap the reward; but when once a good meadow comes into bearing, he who owns it may congratulate himself upon possessing something that is pleasant to look after, and profitable withal.

CHAPTER VII.

FLOODING.

It is now admitted by all, that winter flooding is desirable, and, in most cases, essential to successful cranberry culture, although some plantations have been remunerative without it. Flooding is necessary to insure permanence to the vines, and protection against the ravages of insects.

Savannas are generally looked upon as being less permanent than swamp bottoms; but we know of no instance of vines "running out," even on savannas where winter flooding has been resorted to; on the contrary, worn out meadows have been renewed by building dams about them, and raising the water to cover the vines during winter and early spring.

Flooding not only prevents injury from the cold blasts of winter, and destroys insects and their eggs, but the water has also an important fertilizing effect, which is particularly valuable if the plantation is deficient in muck. Streams flowing through cedar swamps, or rich muck bottoms, become freighted with minute particles of vegetable matter, which gradually settle to the bottom of the pond, and form a fine top-dressing for the vines.

Young plantations should not be flooded until the third winter after planting, unless the vines are infested with worms, or the ground is disposed to heave the roots out while freezing and thawing, which it will assuredly do if the soil is composed of clear muck, or a portion of the oxide of iron. The object, in not covering young vines with water, being to avoid any unnecessary packing of the soil, and also to allow them to commence growing as early as possible in the spring.

Some difference of opinion exists as to the proper time

for submerging cranberry meadows in the fall, some asserting that it may be done any time after picking the fruit. This, however, is an error; for the reason that the vines are known to make a very considerable growth after the first frost, and the berries should be gathered, if possible, before frost.

It is a safe rule to raise the water as soon as the temperature becomes sufficiently low to stop vegetation. The time will be indicated by the vines commencing to assume a dull red appearance.

The water should be kept up all winter, and not let off until, say, the 20th of April or 1st of May in New Jersey, and the 20th of May, or 1st of June, in the latitude of Massachusetts.

It is not safe to keep the water on savannas in New Jersey later than the 1st of May, as it would retard the growth, and render the blossoms and newly formed berries liable to be injured by the hot sun or drouths in the latter part of June or first of July.

Springy bottoms, which are always moist during the dryest seasons, may safely be flooded until the 10th or even the 15th of May without injury to the crop, because there will be sufficient moisture in the soil to perfect all the late and small berries.

Flooding to destroy insects, etc., is alluded to in the chapter devoted to Enemies and Difficulties.

In order to flood a meadow effectually, it is necessary to construct a substantial dam across the lower end of it, and, in doing this, no pains should be spared to render the barrier reliable and permanent.

It is false economy to carelessly throw up an embankment, with turf or muck under it, leaving roots or brush scattered through the sand, and expect it to hold a liquid which is always striving to obey the one great law of its nature; viz., to seek a level. Turf fences or muck will not answer the purpose; the only dam for a cranberry

meadow that may be depended upon, is one constructed of clean sand, free from roots, or pieces of turf, and built upon the solid sand or loam, as the case may be.

If it be desired to build a dam across a meadow containing muck six feet in depth, dig a road *entirely through the muck*, and lay the dam upon a sure foundation, or it will not stand the test.

Before commencing the dam, learn where you want it, and then how large the flood will *require* it to be. Its locality must depend upon circumstances; its dimensions upon the height of water required to flood the meadow. To determine this last point, level the ground with a theodolite, if one is at hand; if not, take an ordinary

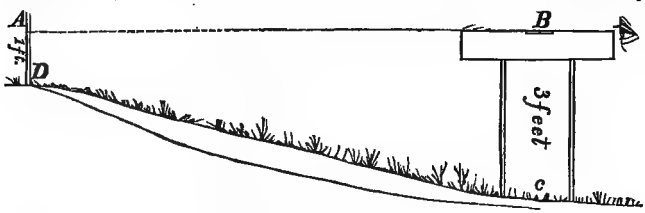

Fig. 26.—LEVELLING.

spirit-level and two boards, and proceed to the lowest spot along the line of the proposed dam; there drive the boards perpendicularly into the earth, eighteen inches apart, and rest the spirit-level on top of them, pointing to the highest knoll you intend covering with water. Bring it to a level by tapping on top of the highest board.

Then send your assistant to the knoll, with instructions to erect a pole, and move a white target up or down it, as you direct him, by the motion of your hand.

By sighting along the top of the spirit-level you will be enabled to judge when the target is level with your eye.

Having established this point on the pole—by a pencil mark—the difference in the height of the two positions may be ascertained by subtracting the height of the mark

on the pole from the height of the spirit-level above the surface of the ground.

By way of illustration, let the mark, A, (fig. 26) be one foot high, and the top of the level, B, be three feet above the ground, C. Then will BC, less AD, equal two feet. And it will require a dam two feet high, erected at the point, C, to raise water to the top of the knoll, D.

Having thus determined the greatest depth of the required pond, build your dam accordingly, making it fully as *thick* as the water will be deep; for instance, if it is found that a "head" of six feet will be required, dig a

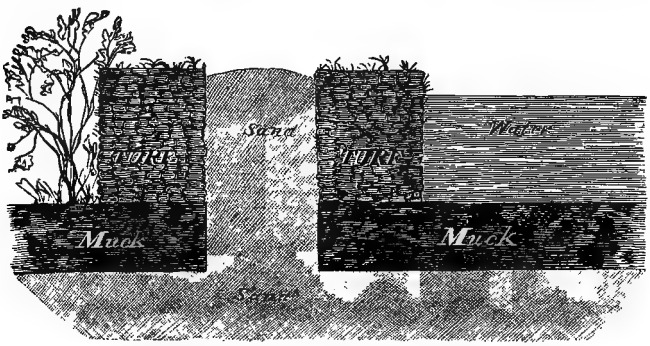

Fig. 27.—A DAM PROTECTED BY TURF.

ditch, six feet wide, *entirely through the muck*, and fill it up with clean sand for the foundation of the dam. On each side of this foundation erect a substantial turf wall, six feet thick, to support and protect the true dam, which is afterward made by filling up and packing with sand the space between the walls.

The dam should be made somewhat higher than it would generally be required, to prevent freshets from overflowing and washing it away. Fig. 27 represents a dam such as we have described.

The object of having turf on each side is not to hold water, but to economize the sand by supporting it just

where it is needed, and also to protect the dam from the rippling water, which otherwise would undermine and wash it down.

The dimensions given for the dam may seem large, but if you attempt to construct one upon the muck, or make the width of the dam less than the required depth of the water, or the protecting walls narrower than the bank of sand, thinking, thereby, to save expense, you may be sadly disappointed.

"A thing worth doing at all is worth doing well," is an old saying, and it is particularly applicable to the building of dams; for the water will be sure to attack the embankment in the weakest place, and a small leak will drain a great pond.

A dam was once constructed in the manner described, excepting that the turf walls were about *half* as thick as the embankment of sand. The result was, upon raising the water, the sand settled down, and forced the walls asunder, threatening to "let all the mighty waters out," which, no doubt, would have been the consequence, had not one of the proprietors adopted the expedient of driving down large stakes on each side of the dam, and connecting them with stout wires, thus sustaining the walls, and preventing them from separating further.

A dam near Tom's River, N. J., built at a cost of $6,000, to flood a meadow containing three hundred acres, broke recently, because of a weakness under the floodgates. The massive gates and a portion of the dam were carried away, which, in connection with having the water drained off in midwinter, has damaged the owner to the amount of about $2,000, besides doing considerable injury to land and mill owners located on the stream below.

Floodgates are necessary in all dams of any considerable size, in order to regulate the depth of water in the pond; but for savannas or heath ponds, where the sup-

ply of water is dependent upon rains, the damming of a ditch, or filling up with sand, a small cut in the embankment will frequently be found sufficient.

For a small stream, and low head, floodgates may be constructed in summer by any ordinary workman, as follows: Select cedar, or other lasting timber, (as the water will be drawn off in warm weather, thus leaving the wood-work in the most favorable condition for decay) and drive down thick planks on each side of the ditch, with their broadsides towards the outlet, for posts. Then fix a plank, ten or twelve inches wide, in the bottom of the ditch, to serve as a mud-sill, and nail it firmly to the posts, letting it extend five or six feet beyond them, to form a portion of the wings. These wings are afterward

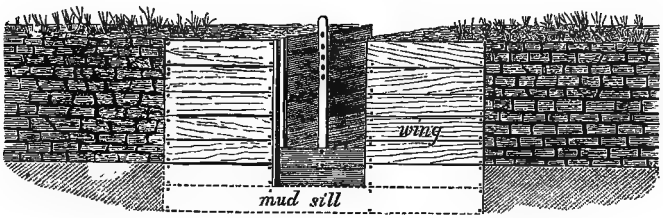

Fig 28.—FLOODGATE.

boarded up along the dam, on each side of the gates, and a sheeting is constructed, reaching entirely through the dam, to convey the water off. (See fig. 28.)

The corners between the wings and sheeting, as well as the space under the floodgates, should be filled up with clean sand. Boards, sliding in grooves above the mud-sill, are employed to raise or lower the head of water.

In large rapid streams, or with high heads, floodgates made in this way would not be efficient. For these, plank, driven down in front of the mud-sill, is the only sure method of preventing the water from flowing under the gate.

Preparations for cranberry culture have become so ex-

tensive of late, that it has frequently been found necessary to construct massive dams of earth, similar to those used for mill-ponds; and where the surface to be covered is very large, it is better to incur this expense than to leave the vines uncovered in winter.

Where a small head of water, say about one foot only is required, the dam may be made by throwing up against the turf fence an embankment of sand, and sodding the

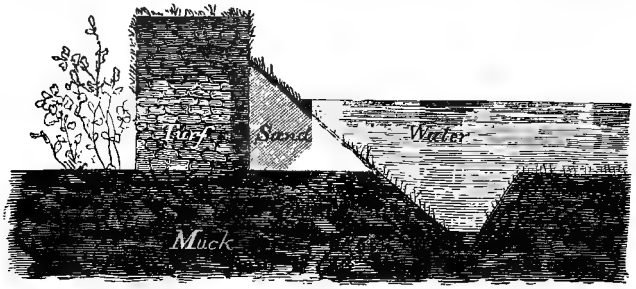

Fig. 29.—EMBANKMENT SUPPORTED BY A TURF FENCE.

face of it with turf, to prevent its being washed down. (See fig. 29.)

A dam of this character may be seen at our twenty-acre meadow, near New Lisbon, rendering efficient service where a head of two feet is required.

The same rule applies to this as to other barriers for holding water, viz.: No muck should be used in its construction, and, if possible, allow it to settle thoroughly before raising a permanent head.

CHAPTER VIII.

ENEMIES AND DIFFICULTIES.

It has been said that horticulture is a battle with insects. The cranberry grower soon learns that his culture, peculiar as it is in many respects, is not exempt from insect enemies. These are usually the chief obstacles in his path, and frequently baffle his efforts and disappoint his brightest anticipations. To successfully fight the insect enemies of the Cranberry, it is necessary, as with those of other crops, to first learn the habits of the depredators, and their mode of attack. Those will be the most successful in repelling insects who give to their habits the most intelligent and careful observation.

Fruit Worm.

Soon after the hopeful cultivator has established his plantation, and while he is anxiously watching its first fruits, he observes some of the berries prematurely turning red, shriveling, and, before picking time, entirely drying up. This destruction is caused by the *fruit worm.*

This larva bears a striking resemblance to the ordinary apple worm, and, like that, is lazy and sluggish in its habits. We have reason to believe that the perfect insect lays its eggs under the tender skin of the newly-formed berry. This egg is hatched by heat, and the young grub eats its way into the heart of the fruit, causing certain destruction. It has been asserted by some cultivators that one worm will destroy one berry only; but this is a mistake; the same worm will frequently destroy at least two. This is fully established by the fact that two berries may be found with a hole passing directly from one to the other, at the point where they come in contact—one being red, and the other fresh and

green, with a nearly full-grown worm in it; as further evidence, we may state that worms have been discovered on the passage from one berry to another.

This premature coloring of the berry—the effect of the fruit worm—has been observed in New Jersey as early as

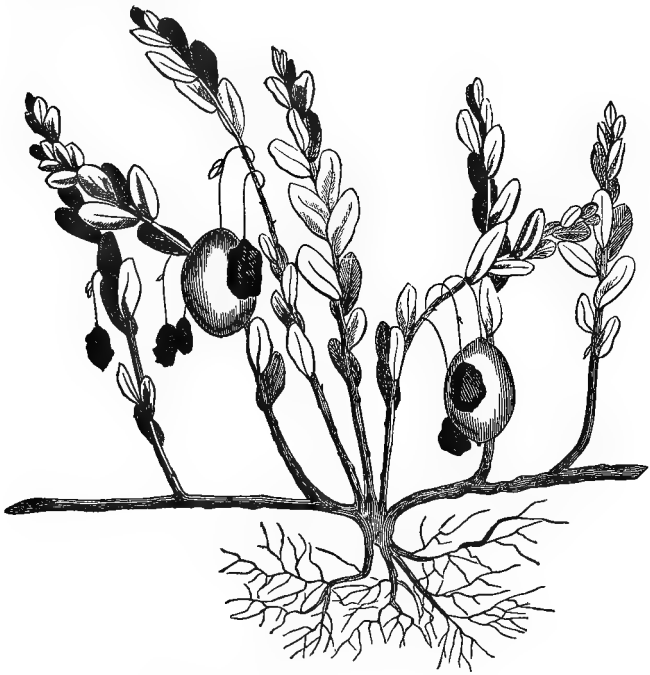

Fig. 30.—WORK OF THE FRUIT WORM.

the 10th of July, on the dryest meadows, and later on those that are moist. Its ravages continue until the 1st of September, after which the remains of the fruit are visible in the form of dry, hollow shells, from which the worms have disappeared. These shells may be counted upon a small space, and the damage ascertained by proportioning them to the amount remaining sound. In dry

seasons, the loss resulting from the fruit worm frequently amounts to one-half of the berries formed; and, in some cases, it has been so great as to leave only one-tenth of the fruit to come to perfection. The work of the Fruit-worm is illustrated in figure 30.

The defense employed against this voracious worm consists in keeping the surface of the meadow *moist*, from the formation of the fruit until toward the middle of August; if it is not so naturally, resort to irrigation. The effect of moisture at this time seems to be to keep the bottom cool, and thereby to prevent the hatching of the worm—after the same manner that weevils are avoided, by allowing the grain to become *fully ripe* before it is gathered into barns; thus preventing its heating in bulk, and hatching the weevils.

James A. Fenwick says: "I have observed natural patches, a rod or two wide, sloping to a stream, where, next the stream, not a berry would be injured, while on the dryer part three-fourths were destroyed—this destruction reaching nearer the stream in proportion as the season was dry or wet. It is natural to infer that the egg is laid in the berry; and on the moist land the temperature is not sufficiently high to hatch it, while on dry ground it is."

Mr. Fish observes: "When fully grown, the worms enter the ground and spin their cocoons within a few inches of the surface. The cocoons are covered with grains of sand, and are hardly distinguishable from small lumps of earth. They remain in the ground all winter. I do not positively know the perfect insect, as I have never been able to rear it in-doors. In the spring of 1867 I bred two species of Ichneumons from these cocoons that had remained in the house over winter."

Vine Worm.

There is another species of larva which feeds upon the leaf of the cranberry vine, and, when uncontrolled, works early destruction upon the whole plantation; spinning

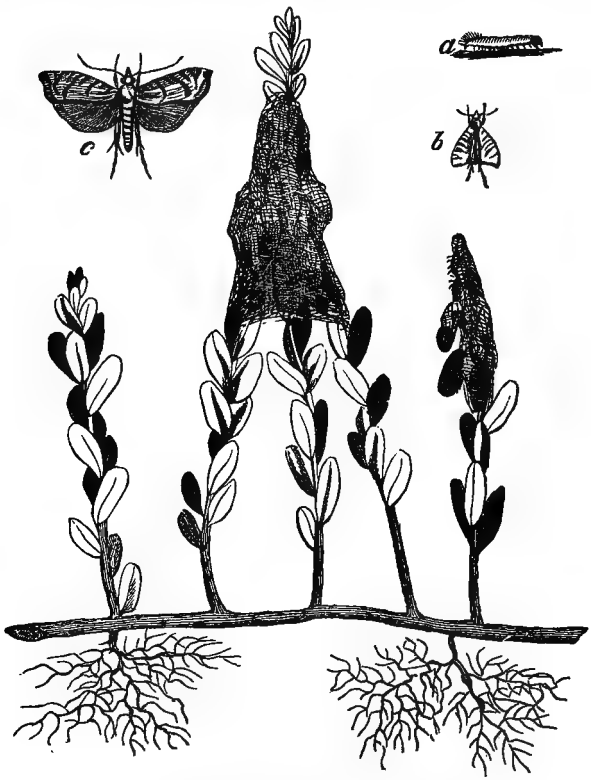

Fig. 31.—VINE WORM AND ITS WORK.
a, Larva; *b*, Moth, natural size; *c*, do., magnified.

its web around the leaves and upright branches, it binds them together, and destroys them. This larva looks very much like the fruit worm in size and color, excepting that

its head is darker, and its body more hairy. Figure 31 shows the larva and perfect insect of the Vine worm, and the appearance of the vines after its attacks.

James A. Fenwick, speaking of the vine worm, says: "It feeds on the under side of the leaf, leaving nothing but the veins, and increases rapidly to a countless multitude, causing the meadow infested by them to appear as if scorched by fire; hence their name, 'fire worm.' Upon observing a meadow infested by them in April, I found the worms feeding upon the leaves, and partially surrounded with webs. In June I noticed they had webs enclosing clusters of vines (ignorant persons thinking them spider webs), apparently for shelter from the weather. Upon approaching them with a heavy tread, the worms suddenly disappeared, dropping to the ground; but, stepping noiselessly, and touching the webs, the worms would drop into my hand, making, at the same time, vigorous efforts to escape. By the close of July not a worm could be seen, but the webs remained; doubtless the worms had enclosed themselves in cocoons. In August, the *millers* arose in numbers around my feet, taking short flights, and again settling upon the ground; by September these had disappeared, and the worms had increased a hundred-fold; evidently showing that two generations of these insects were hatched in one season."

In Packard's Guide to the Study of Insects may be found the following minute description of the *vine worm*, and the moth, of which it is the larva: "Mr. Fish has discovered an undescribed species of *Anchylopera*, which feeds in the cranberry, and which we may call the Cranberry Anchylopera (*A. vacciniana*). The moth is dark ash, the fore-wings being whitish, dusted with brown and reddish scales, with white, narrow bands on the costa, alternating with broader yellowish-brown bands, five of which are several times larger than the others, and from four of them regular indistinct lines cross the wing. The

first line is situated just beyond the inner third of the wing, and is often obsolete. The second line is the largest, and is slightly bent over once in the middle of the wing. There is a large brown spot parallel to the costa, being situated on the angle. The third line is oblique, and slopes before reaching the inner angle, and is forked on the costa, while the fourth line is a short, apical, diffuse, irregular line. The apex of the wing is dark brown, and is a little more acute than usual in the genus. The length of a fore-wing is the twentieth of an inch. It lays its eggs on the leaves during the month of August, and a new brood of larvæ appears in September, though they hatch mostly in the following spring, or early in June, and become fully grown in July.

"The larva, seen from above, is much like that of *Loxotænia rosaceana*, but the head is a little larger in proportion to the rest of the body, being as wide as the body in its thickest part The body is more hairy, while the prothorax is not dark. The chrysalis is rather slender, the body being contracted at the base of the abdomen, on the rings of which there are dorsal rows of fine spines.

"Mr. Fish writes me that these larvæ, called the Cranberry Vine Worms, hatch about the first of June from eggs that have remained upon the leaves of the plant all winter. They commence to feed upon the tender growing shoots of the plant, drawing the leaves together with their web for shelter, concealing themselves, and feeding within. Before reaching their full size, they, if very numerous, almost wholly destroy the leaves and tender shoots, giving the whole bog a dark, dry appearance, as though a fire had been over it. This is why they are, in some places, known as 'fire worms.' Having reached their full size, they spin up among the leaves, or among the dead leaves upon the ground. After remaining in the pupa state about ten or thirteen days, the moths come out, and deposit their eggs upon the leaves.

"This year (1868) the moths were out the last of June and first of July. In five or six days the eggs hatched, and this second brood, which is usually the most destructive, mostly changed to pupa on the 20th of July. On the 26th of July the first moth came out, and most were out before the 4th of August. Most of the eggs laid in August do not hatch until the following spring. I did succeed in finding two or three larvæ in September, but they were rare at that time."

In New Jersey, the larvæ are quite common during the month of September, and may frequently be found in October. We are disposed to believe that many of them live through the winter in sheltered places, securely wrapped in their webs. Turf fences, and densely matted vines, not flooded, affording them a safe asylum. This opinion is confirmed by the fact that large-sized larvæ may be found early in the spring; and also from our having kept a worm in a cold room until March, with every indication of its living until May.

The cranberry was not the principal food of the vine worm until it was brought under cultivation; while growing naturally in bogs and swamps, where it was liable to be flooded during the winter and early spring, it was not well adapted to their requirements. The worm had made its home among the Feather-leaf (*Cassandra calyculata*) and Low-bush Huckleberry, until the days of cranberry culture, when it descended upon the new plantations, and threatened, for a time, their entire destruction. But Yankee enterprise came to the rescue, the meadows were *flooded*, and the worms defeated.

By some it is supposed that there are four generations of these pests in one season; however this may be, by destroying them once a year, they will be rendered almost harmless. To work their destruction, keep the meadow flooded until the 10th of May, in New Jersey, and until near the 1st of June, in Massachusetts; or, *cover the*

vines with water just before they blossom, while the fruit-buds are showing plainly, and hold it on for *twenty-four hours*, but no longer, as the water injures the crop of fruit if left on too long while the vines are in this state. The latter expedient can only be resorted to when a copious stream is at hand.

Plantations that have, to all appearances, become worthless by the ravages of the fire worm, may be restored by flooding. This was illustrated on the "Willow Farm," near Medford, N. J. Upon this tract osier willows had been planted among the cranberry vines, with the object of obtaining a double crop. But, like one who aims too high, and hits nothing, this planter lost both basket material and cranberries; for the worms, attacking the willows, soon spread over the vines beneath, and spoiled all. The meadow remained in an unprofitable condition for several years, when, as a last resort, dams were constructed at considerable expense, and a head of water raised, which resulted in exterminating the worms, and shortly after (in 1867) a crop averaging one hundred bushels per acre was produced. This was quite a recommendation for the farm, and enabled the owner to dispose of it to good advantage. The next year a light crop was general throughout New Jersey, and the Willow Farm was not an exception; but, in 1869, it again yielded handsome returns, and now no danger is apprehended from the "fire worm."

In locations where water cannot be commanded for winter flooding, other means must be adopted to destroy these insects. Professor Agassiz recommends building fires at night around the meadow, while the moths are in existence. The dazzling light attracts them, and many fall victims to the devouring flames.

The same principle is sometimes applied more effectually in the following manner, viz.: a large ball of cotton is tightly wrapped in fine wire, and saturated with kero-

sene; it is then supported by wire over the middle of a cheese-box lid, for instance, with a handle attached, the lid being covered inside and out with fresh tar. Several men, armed with these weapons of offence, proceed to the meadow at night, and, with their lamps lighted, march over the vines within touching distance of each other, all the while moving their lights from side to side. The insects are stirred up and killed in the flames, or caught by the tar. For a new vine worm, see p. 123.

Grasshoppers and Crickets.

Grasshoppers and crickets sometimes commit serious depredations upon the growing fruit. When very numerous, they have been known to destroy one hundred bushels of cranberries per acre. They do the damage by eating a small portion from the side of the fruit, thus causing it to shrivel, until nothing but a dry shell remains. These are easily distinguished from the hollow shells left by the fruit worm. Grasshoppers are most abundant upon meadows containing a large amount of grass; while crickets prefer to work near turf fences, or on some locality which affords them a good hiding-place. These facts offer strong inducements for having cranberry meadows thoroughly cleaned, *i. e.*, free from grasses, brush, etc. It has been asserted that *flooding* will dispose of them; but as the season for their depredations, viz., during July and August, is hot, this would be attended with great risk of ruining the whole crop by scalding. The destructive visits of grasshoppers and crickets have not been very common to cranberry growers, and many have rested in the belief that, when they did come, all that was necessary was to raise the water, then hoist the gates, and let them float down stream. But this will not answer, for the reason that every recruit in that vast army has nimble legs which render him quite competent to "paddle his own

canoe." This water-cure was fully tested near Medford, a few years since, where an eye witness avers that he saw one specimen out beyond his depth actively engaged in teaching diving-school.

It is believed that deep flooding in winter, and clean culture, are the surest means of avoiding the depredations of both crickets and grasshoppers.

Musk-rats and Mice.

Among the enemies of cranberry culturists may be numbered musk-rats and mice. The former sometimes injure the crop by crawling over the blossoms and fruit, and also in boring through dams and letting off the water at unseasonable times.

The latter are addicted to the wasteful habit of eating the seeds, from the berries, both before and after picking, and leaving the remainder entirely worthless. Whole handfuls, treated in this way, may be found at times during picking season. The only remedy for these evils seems to be to trap the vermin.

Frosts.

Frosts occurring late in spring, or early in autumn, are seriously apprehended by the grower. If they come towards the last of May, or first of June, the fruit-buds are liable to be destroyed; and if during September, or while the berries are white and unripe, the effect is to soften and spoil them.

The damaging results of spring frosts are avoided by flooding sufficiently late to destroy the vine worm. This retards the growth of the vines, and buds are not formed until after the danger is past. Care must be taken, however, not to retard the crop too much, lest it be overtaken by frost in the fall.

Upon some meadows, the fruit-buds in spring, or unripe berries in autumn, are destroyed by frost, while others in the same neighborhood escape uninjured. Natural bogs are more apt to suffer from this cause than those which have been sanded. This is partially owing to the dense covering of sphagnum, bushes, etc., keeping the swamp from becoming warmed during the day. In all cases where the soil is barren, deprived of vegetable growths, stony, or sandy, it becomes far hotter by the absorption of the sun's rays, and hence less liable to frosts than one that is covered with plants; for instance, in the deserts of Africa, the heat of the sand often amounts to from 122° to 140° F., while upon the oases, where the surface is clothed in verdure, the temperature of the soil is always lower.

Plants cool much more rapidly by nocturnal radiation than the earth, and this fact, in connection with their being at a lower temperature at sundown, is sufficient to explain why frost is deposited sooner upon vines growing among mosses and grass than it is upon those cultivated upon beds of sand.

But even when the temperature is sufficiently low to produce frost on cultivated meadows, the berries sometimes escape without injury.

It is a peculiarity of frost that, when removed gradually, it loses its power to destroy. Even tender garden plants, when frosted, may sometimes be saved by throwing cold water on them early in the morning.

When frost forms on vines in a swamp, it remains until the rising sun dispels it rapidly, thus causing destruction among the tender buds and green berries, while upon some cultivated meadows, when a slight frost forms during the night, the sand, by reason of its conducting power, thaws it gradually, without any injury resulting therefrom.

James A. Fenwick observes that "cranberries suffer

much more from early frosts during drouths than when meadows are moist, particularly if they are covered with old vines and dry grass; these being non-conductors, the frost remains longer in the morning; and when the direct rays of the sun fall upon the vines, the thawing is sudden, and the fruit is softened." He says, further: "I have observed the effect of frost upon bogs during drouths, when all the berries appeared the same before sunrise, but before noon, those growing on old, thick vines, among grass, were softened, while on sanded surfaces they escaped. Berries, on a strip where the vines (in a natural bog) had been covered with sand, thrown from a ditch, being firm and hard, while on both sides of this strip they were softened."

Excessive Heat.

When berries begin to change from green to white, a temperature of 85°, F., will soften many of them. This fact will cause the culture of cranberries to be confined to a line a little south of New Jersey, as the heat of September (the ripening season) must increase to the southward, so that, although the fruit may be grown, it is likely to be of an inferior quality.

During the summer of 1869, one very hot day was sufficient to destroy hundreds of bushels of cranberries in New Jersey. The berries, being partly cooked, remained on the vines in a soft, worthless condition, until picking time, much to the annoyance of the pickers, who were required to sort them out.

The Scald or Rot.

When cranberries upon the vines appear semi-transparent, as if they were partly cooked, they are said to be scalded. Since the first edition of this work was published, scalding has been investigated by Mr. J. A. Fen-

wick, who has treated the subject at considerable length. His essay will be found in the appendix on page 125.

Grass and Rushes.

Grass and rushes are not the least of the difficulties to be overcome. They should be removed with a hoe the first season after planting; but during the second and third years it will be found necessary either to hand-pull, or carefully take them up with a trowel, to avoid loosening the runners.

The millet-grass, being an exception, need not be disturbed, since it will gradually die of its own accord, and make room for the vines. (See Chapter VI.) Even rushes, it is said, if mowed twice a year, to prevent their going to seed, will give place to the vines. They frequently grow upon lands that are best adapted to cranberry culture.

Late flooding is also a means of destroying grass, etc. (The process is described in Chapter VI.)

Moss.

The moss (*Polytrichum commune*), so prevalent upon lands containing ashes, is objectionable, in that it lifts the runners, and prevents them from rooting in the soil. We know of no better way of disposing of moss than to cover it with an inch or two of sand.

This remedy may be applied even after the vines are one or two years old; the runners should be covered, and the upright branches, if possible, left out. The vines, thus established, will put forth runners, and take possession of the clean surface.

Tip-Worm.

There are other insects beside the vine and fruit worm, which interfere more or less with the cranberry crop,

which, as yet, growers have not discovered any remedy for; of these, Z. H. Small, of Harwich, Mass., writes us: "The most destructive, and the least likely to be noticed by growers, is a very small, orange-colored insect, called the 'tip-worm,' which preys only on the newly-formed buds at the tip of the shoots. This insect is too small to be readily seen, but its presence is indicated by two leaves at the top of the shoot, standing erect, and concaved, or spoon-bowl shaped, on the inner, or bud side. It seems to do its work in the summer, while the berries are growing, and buds forming for the next year's crop. Very few yards are entirly free from this insect; some can be found in almost any cranberry patch, and, in a few cases, they have been known to destroy the whole crop."

The tip-worm has been noticed slightly in New Jersey, but most cranberry growers in this State are unacquainted with both the worm and its works.

Span-Worm.

Z. H. Small also alludes to another insect, which he says is a peculiar kind of span-worm, of a dark-brown color, making its appearance in swamps, and, like the locusts of Egypt, leaving only destruction behind. A few patches in Massachusetts are attacked by it almost every season, but, as yet, they know nothing of its parentage nor its habits, excepting what is witnessed in its work upon the vines. It comes when the fruit is about setting, and there seems to be no way of destroying it except by raising the water, which, at that season of the year, causes the fruit to drop off. This worm is unknown among cranberrry culturists in New Jersey. (See appendix.)

Lack of Money.

Our list of difficulties would be incomplete did we not call attention to the very serious inconvenience which

some have experienced in obtaining money to carry out their too extensively laid plans. We therefore recommend all beginners who are likely to fall into this difficulty, to *count the cost* before beginning, and allow a sufficient margin for contingencies. It is better to complete five acres than, in clearing fifteen, to exhaust the treasury, and leave the vines unplanted.

CHAPTER IX.

PICKING.

If you, persevering reader, have practically followed us through all the matter-of-fact descriptions of locating the meadow, preparing it for the vines, and bringing it into the best possible condition for future profit, you may, perhaps, by this time, have experienced some of the weariness felt by us while living for months in a log cabin, laboring to accomplish the self-imposed task of setting out thirty-two acres of cranberry meadow. If so, we trust when you come to "picking" on your own account, you will realize some of the pleasure and satisfaction incident to finding the fruit of one's own labors abundant.

The picking season is a pleasant one, for several reasons, to both picker and proprietor. The weather is proverbially fine in that most delightful of all months, October, when women and children turn out in great numbers to join the "cranberry picking" frolic, with well-filled dinner baskets and happy countenances.

The price for picking averages about fifty cents per bushel; the hands, at this rate, making $1 per day, although a "right smart" picker can, where the berries are numerous, earn $2 per day.

In New Jersey, we commence picking on savannas about the middle of September; but on our densely matted swamp lands, it is deferred until the 1st of October; the time being regulated by the coloring of the berries. The work should commence as soon as they are sufficiently colored to command good prices, in order that they may all be gathered before the first heavy frost, which may be looked for towards the last of October.

Much care is requisite, while picking, to secure the berries without bruising them. If they are poured into bags, and used for seats by the pickers, or thrown over their shoulders and carried half a mile or so, over a rough road, the loss from shrinkage and decay will be very considerable. But if the fruit is picked in peck baskets or boxes, and poured directly into the packages in which they are to be shipped, no loss from the handling will ensue.

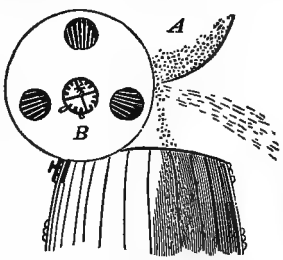

Fig. 32.—PORTABLE FAN.

When dead vines, grass, etc., are gathered with the fruit, they may be blown out while it is being poured into the barrel, by using a very light, movable fan (fig. 32), made to clamp the edge of the barrel, somewhat in the same manner that a clothes-wringer is fastened to the tub. This machine would also remove the dried or shriveled berries, and leave the fruit in a good marketable condition.

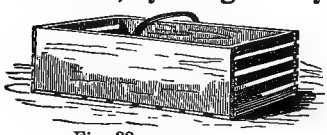
Fig. 33.—PECK BOX.

The idea is for the picker to pour a peck of berries into the hopper, A, and turn the crank B while they are running through. The invention is not patented, and we give it to the public for what it is worth.

We have used peck *boxes*, fig. 33, for picking in, made

of light material, in the following manner, viz.: The sides are of boards, half an inch in thickness, $13\frac{1}{4}$ inches long, and 6 inches wide; about these were nailed thin strips of lath, 9 inches long, making the inside dimensions, when finished, $13\frac{1}{4}$ in. × 8 in. × 6 in., or equal to a heaped peck. A wooden handle is then screwed to the top.

This box is cheaper than a peck basket, gives good satisfaction, and, when properly constructed, will last several years.

In order to pick the meadow over, if the vines have been planted in drills, let each picker take the space between two of the original rows, pick on it for about one hundred yards to a given line, and then walk back and start a new row. The object in turning back is to prevent confusion, which will inevitably result if they are allowed to pick in both directions, or if the rows are long and indistinct.

Where there are no rows visible, but only a solid mat of vines, let the pickers all start in evenly, with instructions to keep in a straight line, which they can nearly do, for a short distance, by the slowest pickers taking the narrowest strips, and *vice versa*.

Sometimes, when no rows are to be seen, the meadow is staked off in lots of a few square rods each (this should be done in spring, to avoid trampling upon the berries), and regularly picked over, each picker taking one lot at a time.

Some care is necessary, at first, to properly discipline the pickers, and cause them to pick *clean* as they go. This may be done by calling them back in a pleasant, but decided manner, to gather any berries that may have been found after them. They will soon take the hint, and perform their work carefully.

It is very important that a reliable and expeditious method of keeping the pickers' accounts be adopted, especially if you have a large quantity of fruit to gather.

The old plan was to pick in baskets, and then pour the berries into bags, only taking them up at noon or night to be measured by the boss; the number of pecks or bushels picked by Till Willitts or Hannah Butler, being then credited to them in his book. The objections to this system were serious: the berries were unnecessarily handled; the trouble of measuring a large lot of fruit, while the pickers were standing around, impatient to get home, was very great; and the accounts, kept under such circumstances, were not always to be depended upon. Hannah would keep her own account; and if, in the settlement, yours did not correspond with it, what could you do but allow hers?

These inconveniences induced growers to look about for something better, which they found in the *peck boxes* or *baskets*, now used. The barrels are taken into the meadow, and deposited in some spot convenient to the pickers. When a peck box is filled, it is brought up and emptied by the picker, who in turn receives a ticket, somewhat like this.

ONE PECK.

(*Grower's Name.*)

Other tickets, of different colors, and larger denominations—for instance, ONE BUSHEL, and FIVE BUSHELS—are convenient to exchange for these. The object in having them of different colors is, that they may be distinguished at a glance, without reading.

This does away with all measuring, all book accounts, and all mistakes. The tickets represent so much money, and are frequently used as such at the neighboring stores.

Another method is to have each peck box numbered, in large figures, and keep the accounts in a book; the picker's number being used instead of her name. The advantage

claimed for this plan is, that the proprietor may make the entry in his book without walking to the picker to present a ticket. It certainly allows him more liberty, and a better opportunity to look after the pickers, and keep them straight.

Jos. C. Hinchman has adopted this mode: he uses a different colored pencil for keeping the record of each day of the week, which enables him to tell just what has been done upon any day. When the hands are paid off the record is cancelled.

The fruit may be put up for market either in barrels or boxes; if the former are used, new barrels should be obtained, with a capacity of two bushels and three pecks each. When second-hand ones, holding three bushels, are used, they must be filled, and then will sell for no more than the *standard* barrel.

The peck of fruit thus lost to the grower would pay for the new package. New "cranberry barrels" may be had in Philadelphia for fifty-eight cents apiece.

If *bushel boxes* are preferred, they may be made in the following manner: Take a board, three-fourths of an inch thick, and 6 inches wide, and saw it into pieces 18 inches long; then, using two of these pieces for ends, nail around them strips of ordinary plastering lath, 2 feet in length, leaving spaces between them for ventilation. The strength of the box may be increased by nailing strips over the ends of the lath; these strips will also answer a good purpose in keeping the boxes slightly separated when stored in large quantities. These packages hold a *heaped* bushel, and cost, at this time, about twenty cents each. For New Jersey standard packages see p. 129.

Barrels are the most desirable for shipping in; but even where they are used, it is best to have a lot of ventilated boxes for drying wet berries in, previous to barreling them. They will be found useful during damp days, or early in the morning, while dew is on the fruit.

Some years ago, when natural cranberry bogs in New Jersey were regarded as public property, even as the huckleberry bushes are now, any one being allowed to gather the fruit, the "cranberry scoop" was freely used. This combed the berries off, and also pulled out large quantities of old vines and dead grasses, the removal of which, it is said caused the bogs to yield more abundantly.

The "cranberry rake" has been used in Massachusetts for gathering berries from cultivated meadows, but it is not destined to come into general use. Among young vines it is damaging to the runners; but old meadows are evidently improved by its use, since many of the dead vines are thereby removed.

The rake does not injure the fruit by bruising when handled carefully; but its unprofitableness is owing principally to its wastefulness, too much fruit being dropped and trodden under foot.

When berries are cheap, or difficulties arise in the way of picking, some advise flooding the crop in the fall, and leaving it to be gathered in the spring. But there are objections to this plan; for instance, if the meadow is flooded early enough to save the fruit from frost, there is danger of injuring the fruit-buds, and destroying the hopes of a crop the ensuing year; and if they are not covered until late, the berries will be frosted, and of little value in the market, besides being expensive to gather.

Efforts have been made to perfect machinery for picking cranberries, but so far without success.

CHAPTER X.

KEEPING.

Cranberries grown upon meadows covered with a heavy growth of vines keep well, while those gathered from plantations imperfectly matted, with white sand visible through the vines, are more disposed to soften, and rot early. This is, perhaps, owing to the reflected heat from the sand, together with the direct heat of the sun, ripening them too rapidly. Little spots, apparently the result of heat, may frequently be seen upon the sides of these berries, and when thus affected, they should be sent to market at once, as they will not keep long. As a rule, it is always best to sell cranberries grown upon young plantations, or on vines not well matted, as soon as they are sufficiently colored. This spotting of the fruit is not wholly confined to meadows thinly set, but may, at times, be seen upon berries produced amid the rank growths of natural bogs, especially when the weather is very hot at the time of ripening.

Cranberries free from spots, and carefully handled to prevent bruising, will keep well in places suitable for storing apples or other fruit, with *as low a temperature as possible and yet avoid freezing.* Thorough ventilation is also very essential; hence, for keeping, the bushel boxes, previously described, are preferable to barrels; for the reason that they permit the air to circulate freely.

The sun's rays have a softening influence if allowed to shine upon cranberries after they are picked; as was illustrated by an individual who stored some berries in open bins, upon a shed floor; the sun, being allowed to shine through a small window upon them, caused a portion to decay very rapidly.

In another instance, a lot of fine berries were put in

bushel boxes, and placed for a few weeks on a porch opening to the south. Those in the rear, which were protected, kept well, while the berries that were in front, exposed to the sun, rotted badly.

Some years ago, it was thought that cranberries could be kept on a large scale in a stream of clear running water. To try the experiment, we put a half-bushel of berries in a slatted box, and secured them soon after picking, in a stream of the pure amber-colored water so common in the pine region.

These berries were picked from young vines, and would have rotted early in the open air; but when they were taken from the water, about the middle of May, we found them still fit for immediate use, although entirely too soft for shipping. It was found, also, that a gelatinous substance had formed among them, which was difficult to wash out.

They may be profitably kept for family use by placing them in stone jars with pure water. Wooden vessels should not be used for this purpose, as they impart an unpleasant flavor to the fruit, unless the water is changed frequently.

Joseph Hinchman has adopted a novel method of keeping cranberries in large quantities, and it is said to answer a good purpose.

His plan is to put the fruit in large shallow boxes, with perforated bottoms; these boxes are then stored in tiers, and a current of air, made alternately wet and dry, is forced up through them by means of a blower, propelled by water-power. Blowing a dry current for a few hours, and then moist air for the same length of time, it is claimed, has a tendency to prevent decay, and also to redden the light-colored berries.

The moist current is obtained by allowing a small stream of water to fall upon the rapidly revolving wings of the blower, when it is instantly converted into spray,

or mist, and forced with the air through the main pipe leading under the berries.

The coloring process may be assisted, also, by spreading the fruit four or five inches thick upon a shaded floor, and leaving them thus for a few weeks. This fact was well known to the enterprising inhabitants of the "Pines," who were wont to gather the natural cranberries in an unripe condition, in order to secure them before their neighbors. The white specimens thus obtained were invariably spread out and colored under an arbor of green boughs and leaves, made thick enough to exclude the sun's rays.

More or less decay will always result from attempting to keep cranberries through the winter; and the grower who stores for a higher price will find it to his interest to sort the berries before selling them. The sound fruit usually becomes well colored by keeping, and will command the highest market price when offered for sale; while the soft berries are generally acceptable to the pie makers, at lower rates.

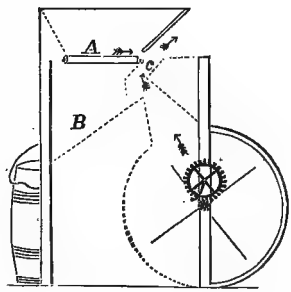

Fig. 34.—CRANBERRY FAN.

If they require winnowing previous to sorting, a fan, similar to that represented in figure 34, will be found a decided improvement upon the grain fan, so commonly used for this purpose.

The endless apron, A, forming the bottom of the hopper, gradually carries the berries forward, and drops them upon the inclined plane, B, from whence they pass to the barrel. Motion is imparted to this apron by a belt connecting with the farther end of the fan axle. While the berries are passing through the air channel, C, a strong current from the blower separates the trash from the fruit.

This fan is the invention of James A. Fenwick, and is annually used by him for cleaning the berries obtained from his improved natural meadows.

Cranberries may be rapidly sorted by allowing them to roll down a smooth, shallow, inclined trough. The rotten berries, not rolling readily, may be picked out, while the sound ones, by reason of their greater firmness, will pass on to the receiver below.

It may not be inappropriate to give some recipes for preparing cranberries for the table; since there are many who, as yet, hardly know what they are, much less how to cook them.

For instance, a story is related of an Englishman who, upon receiving a barrel of cranberries from a friend in America, acknowledged the receipt of them, stating that "the berries arrived safely, but they *soured on the passage*." We are left to infer that the uncooked fruit was served up in cream, a mode not approved of in New Jersey.

Cranberry Sauce.

Dissolve one pound of loaf sugar in one pint of water, bring to a boil, and add one quart of cranberries. Cook about fifteen minutes, or until clarified.

For Tarts, spread the sauce, when cold, upon shells of puff paste.

Cranberry Jelly.

Pick and wash the cranberries, and put them over the fire, with half a pint of water to each quart of berries. Stew them until they are soft, then mash them, and strain the juice through a jelly bag; to each pint of juice add one pound of loaf, or pulverized white, sugar. Boil and skim until a jelly is formed, which can be told by drop-

ping a little in a glass of cold water. If it falls to the bottom without mingling with the water, the jelly is done. When it is lukewarm, pour it into glasses, and let them stand until the following day; then cover them with brandy paper, and paste them closely.

Preserved Cranberries.

Sort the cranberries, and use only those which are entirely sound. Take one pound of loaf sugar and one pound of fruit. Pour on water enough to dissolve the sugar, and cook until clear. Put them up in the manner described for jelly.

Canned Cranberries.

Stew the cranberries, as for sauce, and, while hot, put them in cans, heated in boiling water, and seal them up perfectly air-tight.

Canned cranberries are used extensively on ship board; and during the late "American conflict," a cheap article was manufactured for the army, by using half a pound of brown sugar to each quart of berries.

Exporting.

Although much has been said concerning the exportation of cranberries to Europe, very few have, in reality, been sent abroad, owing, doubtless, to the high price which the fruit has commanded in this country.

Boston has, until within a few years, been the headquarters of this fruit; but we learn that, for the twenty years previous to 1868, not more than forty barrels had been exported from that city.

One lot, sold at public auction, in Liverpool, in 1867, netted the exporter about as much as he could have obtained at the time in Philadelphia.

The fact is clearly demonstrated that, should our markets really become overstocked with cranberries, new channels of trade would be opened to drain off the surplus. But, as yet, the American market is not fully developed.

There are, doubtless, many little towns throughout the country, the inhabitants of which are not acquainted with the cranberry. While the fruit is worth $15 per barrel in New York, no one troubles himself to introduce it into small places.

Should one or two abundant crops be followed by low prices, the demand would be greatly increased; for the reason that there are hundreds of families, not using them at $4 per bushel, who would become purchasers at $2; and, in course of time, consider the fruit as a necessary item in their stock of winter provisions.

Several years ago, we were recommended to transport our berries across the ocean in tight barrels containing water. But in these days of quick passages, all that is necessary is to select *good keeping berries*, from well matted vines, and ship them in new, dry barrels, well packed, to prevent shaking and bruising.

CHAPTER XI.

PROFIT AND LOSS.

The cranberry business is no longer looked upon as speculative. It now takes its rank among those legitimate occupations which make good returns for well bestowed labor; but, like any other business, to be pursued profitably, it must be conducted upon right principles, and with strict attention to details.

Some, from a peculiar knowledge of what was required, and others, more by good fortune than good management in selecting a locality, have achieved brilliant results; but many have failed, and many are now entering the business who will be disappointed. Did we herald the successes, and pass the failures by unnoticed, we would not be doing our whole duty; yet the failures have not been without causes, and the principal of these are *ignorance* and *extravagance.*

A New York firm, operating through an agent, we are told, spent *twenty thousand dollars* in preparing and planting a cedar swamp bottom near Manchester; we visited the tract in 1867, and to us it had the appearance of an entire failure. The trouble seemed to lie in the sand used in its preparation, iron ore being abundant in the vicinity. There are, however, some valuable meadows in the neighborhood of Manchester.

Perhaps one of the most successful meadows in this State is a "little pond" in Burlington Co., containing twelve acres. It has been planted some ten years, and we understand that the original cost of "putting it out" did not exceed five hundred dollars. In 1869, we saw upon a spur of this pond a patch of vigorous vines which had been in existence at least thirty years, and the proprietor informed us that he had never gathered from them, at one picking, less than one bushel and a half per square rod, and sometimes they yielded two bushels per square rod.

In another instance, one square rod of the best vines in this meadow was staked off, a line drawn around it, and the berries carefully picked; whereupon it was found to yield six bushels and two quarts, or at the rate of *nine hundred and seventy* bushels per acre. In 1868, three acres of this meadow yielded an average of three hundred bushels per acre, and one acre produced a net income of $1,800. It is said that $20,000 have been refused for

this meadow, which is not remarkable, considering the income it produces.

The figures given above may seem large, but we believe them to be entirely accurate. They are beyond comparison with the profits of any other agricultural production, and have rarely been equalled, even in the cranberry business, although sensational writers have asserted to the contrary. It is a good meadow that averages one hundred bushels per acre annually; many do not yield half that quantity, and yet are quite profitable.

The cost of preparing the ground varies with its location, quality, amount of damming required, etc.; and, at best, our estimates would only be approximate. The *average* expenditure for completing one acre, where the plow will turn up sufficient sand, is as follows:

Original cost of land, say	$30.00
Ditching and damming	10.00
Turfing, 25 cents per square rod	40.00
Removing turf (into fences, or otherwise), 25 cents per rod	40.00
Removing stumps, $2 per day, say	15.00
Levelling inequalities of surface	6.00
Plowing	3.00
Harrowing and making drills for vines	3.00
Ten barrels of vines, at $3	30.00
Dropping and covering plants	8.00
	$185.00
Expense of weeding 1st year	$ 8.00
" " " 2d "	6.00
" " " 3d "	4.00
" " " 4th "	2.00
Four years' interest on first cost, at 7 per cent	51.80
Total expense at the end of 4th year	$256.80

PROBABLE RECEIPTS.

1st year, 1 peck, at $4 per bushel, net profit	$ .50
2d " 1 bu., " " " " " "	3.00
3d " 8 bu., " " " " " "	24.00
4th " 80 bu., " " " " " "	240.00
Net receipts at the end of 4th year	$267.50

A meadow of this class should pay for itself in four

years. The crop of the fifth year frequently exceeds that of the fourth; and if the plantation is a heath pond, or moist basin place, and is flooded during winter, and properly managed, it will continue to bear for many years. After the fourth year, the expense of weeding will be very little, indeed almost nothing. The vines should completely cover the surface, forming a dense mat that excludes all other vegetation.

Where the muck is of sufficient depth to require sanding, this additional expense will bring the first cost up to about $275 per acre; although, in some instances, it has required twice that amount to prepare and plant the meadows and construct the dam. The cost varies with the width of the meadow, depth of sand required, etc.

It is not the most expensive meadows that are most profitable; for instance, one in Ocean County, we are informed, cost $800 per acre, and yet is very unpromising.

First-class meadows, in bearing condition, command high prices. Several years ago, S. H. Shreve purchased a tract, near Toms River, for $1,000 per acre; and even at this high rate it is said to have paid for itself in three years. This meadow was originally a dense cedar swamp, and was prepared by clearing away the timber, turf, etc., and spreading several inches of sand upon the muck. The sand in the vicinity was of a yellowish color, although entirely free from loam. About the year 1863, Restore B. Lamb commenced operations upon a heath-pond bottom near Pemberton. There was but little turf to remove, and in three years he finished planting the vines upon ten acres, at a cost of about one hundred dollars ($100) per acre. These grew luxuriantly, and, in 1867, when only seven acres of the meadow were in full bearing, the yield was twelve hundred bushels, which produced a net income of over three thousand dollars. In 1868, owing to a partial failure of the crop, the profits amounted to only about one thousand dollars. In 1869, the crop was esti-

mated, early in the season, at two thousand bushels; but, owing to excessive heat, and the ravages of the fruit worm, only eleven hundred bushels were gathered.

When the first edition of this work was published, in 1870, the business of growing cranberries was regarded as extremely profitable, and a large amount of capital was invested in it. As the acreage extended, the drawbacks increased. About the year 1873, the rot or scald prevailed to such an extent as to render the business extremely hazardous. A few choice locations are comparatively exempt from its ravages, but most of the meadows in New Jersey are affected. The insect enemies have also increased so that it is now probable that all the receipts derived from the sale of the fruit would fail to pay the expense incurred in purchasing and preparing cranberry meadows.

CHAPTER XII.

LETTERS FROM PRACTICAL GROWERS.

Chicago, Ill., Feb. 7th, 1870.

Dear Sir:—In reply to yours of 22d, would say, as to the culture of our marsh, and the superiority of our berries, we think it is owing to the large depth of our peat bed. The alluvial soil, deposited every spring by the large overflow of several miles, deposits entirely in our marsh. . We also attribute our success in part to the numerous ditches we have; in all, we calculate from 16 to 18 miles in extent.

We keep our vines well flooded during the winter, and, on account of the late June frosts we are subjected to, we rarely raise our flood-gates until the 15th of June.

We are subject to early frosts in the autumn. In 1868, we had a very promising crop—estimated at 2,500 barrels—but owing to the early frosts, only picked about 400 barrels sound berries.

In 1869, the large flow of waters drowned us out nearly, and the crop was very light. We consider it a precarious crop, at best. Yours truly,

S. A. SACKETT.

The cranberry marsh above alluded to is an improved natural bog, containing six hundred acres, near Berlin, Wisconsin.

Hyannis, Mass., Feb. 22, 1870.

Dear Sir:—I cannot express strongly enough the necessity there is for all beginners in cranberry growing to procure vines from reliable sources—those which are known to be productive, and free from rot. For three years past much complaint of the rot is heard among growers. The fruit commences to decay about the time of ripening, and often destroys the whole crop. Careful observers are learning that, while some varieties are subject to this disease, others are entirely exempt.

The profits of cranberry culture are usually large—beyond comparison with any farm crop raised about here. I am acquainted with a bog, containing a little short of two acres, that has, during the last ten years, yielded its owner ten thousand dollars, *net profit*, or an average of one thousand dollars per year, clear profit.

I am interested in a young bog of 140 rods, and herewith give a memorandum of the crops for the three years just past:

1867, gathered 35 barrels, worth $11.00 per barrel	$385.00	
1868, " 37 " " 12.50 " "	462.50	
1869, " 30 " " 10.00 " "	300.00	
Gross receipts	$1,147.50	
Expenses each year, gathering and marketing fruit, cleaning drains—		
1867	$110.00	
1868	120.00	
1869	100,00	$330.00
Profits for three years		$817.50

The original cost of this 140-rod bog was two hundred and fifty dollars (250), which cost includes the first cost of land, and expenses of hoeing, etc., up to the time of the first crop, in 1867.

Wishing you success with your book,

I am yours, etc.,

A. D. MAKEPEACE.

Yarmouth Port, Mass., Feb. 21st, 1870.

Dear Sir:—The whole story, all that is essential to be known, may be comprised in a small compass.

1st. The soil, or bottom, should be peat, or peaty matter. No cold springs—a head of water, so that the bog can be quickly flowed at any time.

2d. Remove all roots and turf down to the peat, where it is deep. Cut ditches around the edge of the bog, two feet deep, and three feet wide, and others across the bog, if required, to drain it. Cover with sand that contains no loam (and that will not adhere when pressed in the hand), from three to twelve inches deep. Where the peat is deep, the most sand is required. Set vines in hills or rows, two feet apart. Yours truly,

AMOS OTIS.

Harwich, Massachusetts, February, 1870.

Dear Sir:—In reply to yours of the 2d, would say that, about twenty-five years ago, I prepared two small patches of muck swamp land by clearing off the bushes and surface turf, or that containing the roots, then covered it some three or four inches with sand and gravel, set out the vines, and kept the water within two or three inches of the surface.

The vines grew very slowly, but grass and weeds luxuriantly, and both patches proved an entire failure.

A few years afterward, I wheeled off the gravel and

loam from both patches, and put on three or four inches of sand and gravel that was entirely free from loam or clay; drained so that the water in the ditches was from twelve to eighteen inches below the surface, and then set the vines, as we usually do, in small hills, of six or eight shoots, or pieces, eighteen inches apart each way. The vines grew well, and with very little trouble from grass or weeds; have had, generally, fair crops, which convinced me that the failure in my first attempt was not on account of soil or location, but wholly owing to the wrong material used in covering the muck, or mud, and keeping the ground too wet.

My next operation in the way of cranberry culture, and the one that has, I think, been the most profitable, or paid the best percentage on the original cost of any patch in this region, was on a peat swamp of about two acres; the growth upon it was huckleberry bushes, small maples, and a kind of low bushes, with us called laurel bushes. The soil was from one to three feet of turf and peat, underlaid with a thin stratum of white sand, then a hard pan. The swamp could be drained and flooded almost any time from a pond near by. This patch I prepared as the others before named, putting on the white sand taken from the edge of the swamp and upland. Set the vines, which, by way of accident, proved to be about the best vines yet found in this part of the country. They grew well, and put out for a fine crop on the third year, but, while in full bloom, the vine worm made its appearance. After four or five days, not only the blossoms were destroyed, but there was scarcely a green leaf to be seen. I had flooded it every winter and spring to about the first of April, when I let the water off. That was the usual time for letting off by the cranberry growers in this vicinity. So, that year, this patch, as far as crop was concerned, was an entire failure. About this time, which was about 1854–5, the vine, or fire worm, had taken

almost full possession of all the cranberry yards on the Cape. After trying various experiments, such as sprinkling over the vines with ashes, lime, pepper, tobacco, and several other articles with no good results, the growers became very much discouraged, and began to feel like giving up the business as a failure; but, in the spring of 1857, I concluded to try the experiment of keeping the water on or over the vines later than usual, and did not let it off until the 4th of June, and flooded and let off again three times up to the 20th of June, letting the water stay on each time from twenty-four to forty-eight hours; the result was the vines were undisturbed by the vine worm. They put out well for a crop, and, after quite a portion of the fruit was eaten by the fruit worm, I harvested about 110 barrels. Those repeated floodings, in this case, were to make sure work of it. I don't find it actually necessary to flood more than once where the water can be kept on until it is warm enough to destroy the egg of the vine worm, which is deposited on the under side of the vine leaf. I find that the insect takes no note of the month, or day of the month, in making its appearance, but is governed entirely by the temperature of the air or water. In a forward spring, in a warm, sheltered location, the water may be let off earlier than in those locations more exposed to the wind, or where the water is supplied from cold springs.

Where we have the means of flowing at pleasure, I think it as well to flow soon after picking time, and let the water off after the hard frosts—here, in Massachusetts, about the 20th, or last of May. The greatest difficulty I have to contend with now is an overgrowth of vines. I have tried several methods to overcome this trouble, but the only one that seems to promise any favorable results, is putting on, or among the vines, some two or three inches more of sand; the best way, I find, is to spread it on the ice when the vines are flowed in the winter. The

process of flooding, and especially of late flooding, does something to prevent the ravages of the berry worm, and it is at least a partial remedy for this evil, which most cranberry growers have to contend with.

There are several other insects that interfere more or less with our cranberry crops, which, as yet, we have not been able to find any remedy for; the most destructive, and the least likely to be noticed by growers, is a very small, orange-colored insect, called the tip-worm, which preys only on the new-formed buds at the tip of the shoots. This insect is too small to be readily seen, but its presence is indicated by two leaves at the top of the shoot standing erect, and concaved, or spoon-bowl shaped on the inner, or bud side. It seems to do its work in the summer, while the berry is growing, and buds forming for next year's crop. Very few yards are entirely free from this insect. Some can be found in almost every cranberry patch, and, in a few cases, they have been known to destroy the whole crop.

There is also a peculiar kind of span worm, of a dark brown color, which makes its appearance in swarms, like the locusts of Egypt, destroying everything in their way. We have a very few patches attacked by them almost every season; as yet, we know nothing of their parentage or habits, except what we witness in their work on the vines. They come when the fruit is about setting. The worm and the fruit may both be destroyed by flooding—that is, the worm will drown, and the fruit drop off.

Respectfully yours,

ZEBINA H. SMALL.

To J. J. WHITE:—After nearly twenty years' personal experience in cranberry culture, and a favorable opportunity of observing the practice of other cultivators, I have come to this conclusion. For the successful cultivation of this fruit the following requisites are necessary:

First.—A peat or muck soil, free from loam or clay.

Second.—Clean beach sand for covering the peat.

Third.—A dam and water, to overflow the vines when necessary.

Fourth.—Thorough drainage.

With all these advantages, apparently, there have been some failures—without them I know of no one who has profitably cultivated this crop.

The limit of profitable cultivation of the cranberry will probably be found between the thirty-ninth and forty-second degrees of latitude. North of this, the period between the ripening of the berry and frost is too short for harvesting the fruit. South of it, the temperature is too great for properly ripening the fruit.

Frosted berries are improved for immediate use, but will not bear carriage.

When the fruit is grown, and ripening, exposure to the sun, with a temperature of ninety degrees, Fahrenheit, scalds the fruit, and renders it worthless.

Good cranberry ground can be selected with much certainty by observing the natural growth of vegetation; the best are those deep peat bottoms, in which the White Cedar or Juniper flourishes.

Next in value are the heath ponds, with a thinner muck deposit, generally marked by a growth of Gander Bush (*Cassandra calyculata*); if these can be flowed with brandy-colored cedar swamp water (which derives its color from the muck or peat held in solution), they are very little inferior in value to the first. Other soils may sometimes repay the expense of preparation, but are best avoided.

Good unimproved cranberry soil, without timber, is worth from twenty-five to fifty dollars per acre.

Properly preparing and planting the ground costs from one hundred and fifty to five hundred dollars per acre.

First-class meadows, with three-year-old vines, have a

market value of about one thousand dollars per acre. Some have sold for that price, and repaid the purchaser in three years. A few extra meadows have sold for fifteen hundred dollars per acre.

If properly prepared, the expense of keeping a cranberry meadow free from foreign growth is very small—averaging, probably, from three to ten dollars per acre, per annum.

Picking is done by hand, and costs fifty cents per bushel. Bushel boxes, thoroughly ventilated, and cleated at the ends, so that they cannot lie close together, are best for preserving fruit that is stored. These boxes cost from sixteen to twenty cents each. The fruit, if well colored, should be placed in them in the meadow, to avoid unnecessary handling; then carried in a spring wagon, and stored in a cool cellar.

Fruit should be well colored before storing. If not so when picked, it should be spread thinly on floors, exposed to the light, but not to the sun.

The market value of cranberries, during the winter just past, has ranged from three to seven dollars per bushel.

Juliustown, N. J., 3mo., 4, 1870.

BARCLAY WHITE.

The following is the experience of Samuel H. Shreve, of New Jersey.

February, 1867.

In selecting a site for a cranberry bog, it is first necessary to ascertain if there be a peat or muck bottom, as, without this, our labor will be wasted. The peat should be without any mixture of loam or mud, and when taken out of the swamp, and dried, should be light and flaky. Its depth is not of consequence. In our swamps, it is found varying in depth from six inches to fifteen feet, and even of greater depths. It rests, generally, upon a coarse

white sand, and is mostly found of the best quality in cedar swamp bottoms. Its depth can be found by running down a pole.

The next requisite is thorough drainage, which is equally important with the peat. If the swamp or land selected cannot be thoroughly drained, so that the water can be brought at least twelve inches below the surface, it had better be abandoned, no matter how advantageous the location may be, how well adapted the peat, nor how easily it is flooded.

Having cleared the swamp of all turf and vegetation, smoothed the surface, and thoroughly ditched and drained it, it is then ready for the sand. This should be clean, coarse, and entirely free from any mixture of loam; otherwise, it will pack hard, and prevent the roots of the vine from spreading, and from reaching the peat or muck beneath. The runners cannot take root, and the plant will scarcely extend beyond the hill in which it is planted.

Without the sand, vines planted upon peat will grow luxuriantly, and may bear one or two crops. The surface becomes covered with a dense growth of long runners and uprights of twice the usual length. The runners become woody, and the uprights are soft and flimsy. The presence of sand is absolutely necessary in the growth of the healthful and fruitful vine. The vigorous, short uprights, full of berries, will have, when drawn through the fingers, a rough, grating feeling, compared with the long, barren uprights, grown upon pure peat.

In addition to checking the too luxuriant growth of the vine, and affording a requisite element of its proper food, the sand, to a very great extent, prevents the growth of weeds. The depth of the sand upon the peat should not be less than six inches.*

* When the muck is only one foot thick, two or three inches of sand will be found sufficient.

J. J. W.

Imperfect drainage will promote the growth of weeds, and check that of the vine.

Flooding, though not absolutely necessary, is still very important. Judiciously managed, it will almost entirely protect a bog from the ravages of insects.

The vines should be set out in the spring, and a little more care taken here, than is usual, will greatly advance their growth. A bunch of vines is often placed in a hole, or furrow, and the sand pressed around them; and they are kept in an upright position, so that the runners have a difficulty in reaching the ground. Some little pains bestowed upon the arranging of the roots, and placing the vines in an inclining position will be well repaid.

There are many pieces of low ground in this country where there seems to be, naturally, the proportion of sand and muck, and where it is necessary only to take off the turf and plow the ground to make it ready for the vine. In other places, after the removal of the turf, the peat is of so little depth that the plow will bring up the sand.

We have, growing wild, in addition to the Bell, Bugle, and Cherry varieties, others as well defined, and as valuable.

Cranberry cultivation is yet in its infancy, and we have much to learn concerning it; and a little observation of the great number of bogs that are now making will teach us, from the great variety of soils on which they are made, and the different methods of making them, valuable facts, in many cases, at a heavy expense, to unsuccessful cultivators. But of these facts I feel assured; that a good peat bottom, pure sand, thorough drainage, and a proper flooding, will insure success. I have never known them to fail. Bogs have succeeded with but a part of these requisites, and similar bogs have failed. Because vines are found growing upon the surface of the water, twenty feet from land, where it is several feet deep, it is no reason that a bog should be flooded the whole year. Neither is

the growth of wild vines any indication that the soil there is peculiarly adapted to them; nor is their absence any argument against the choice of a swamp. Exposure is of no consequence. As compared with Cape Cod, our bogs are now cheaply made, less liable to injury from frost, and as productive; our berries are larger, of finer color, and of better flavor.

* * * * * * * *

March 28th, 1870.

The vitality of the cranberry vine is so great that, after it has been transplanted four or five years, if the season should be favorable, the yield is likely to be very great. This fact misleads many, and is the cause of many foolish theories.

Many again form theories without ever having seen a successful cranberry bog. I mean one that averaged, from the time it was five years old until it was ten years old, about 200 bushels per acre for every acre in vines.

This large yield is not owing entirely to the soil, etc., as the following instance will show. Near mine was a bog of just five acres. It had never yielded much over 600 bushels, though it was about seven years old. On my recommendation a friend bought it for $6,500. I directed the care and management of it, and the next crop was 1,500 bushels. Since then, the crop has been from 1,150 to 1,300 bushels, yearly—an average of over 200 bushels per acre. The former owner now offers $10,000 for the bog. I felt very confident of the result, for the vines were of a good variety, the soil and exposure excellent.

My bog has never produced so large a crop, its largest being over 2,000 bushels on $7^1|_2$ acres, and its average about 200 bushels per acre.

In a few words I will give you what I consider absolute requisites:

A good, rich muck, entirely free from loam or clay; pure, clean, white sand; good water; and first, last, and all the time, drainage, drainage, *thorough drainage.* I sometimes think that you can almost produce any effect upon a cranberry bog by proper drainage.

There are many other points to be attended to, the chief of which is the vines. The habits of the vines differ greatly. Some appear to grow like trees, throwing out uprights from uprights, never taking new roots, but yearly increasing the size of the main stems, or runners. Others show a stronger disposition to form new roots, and seem to drop the old uprights, as new ones grow directly from the runners. These are more uniform in their yield, while the former produce larger crops; but I believe will not live longer than about twelve years without resanding or pressing into the earth.

I am, very respectfully,

S. H. SHREVE.

Pemberton, N. J., March 27th, 1870.

Dear Sir:—I received yours of late date a few days ago, wishing me to give you my experience in the cultivation of cranberries, which, I have no doubt, is similar to the experience of other growers whom you have consulted. I have been in the business of growing cranberries for about twelve years; and, while all the ground that I have planted has paid well on the investment, some has not succeeded to my expectations, while other has succeeded far above them.

At the time I commenced to cultivate the cranberry, it was a new business in this neighborhood. I had to gain knowledge by experience, which is by far the best way to acquire it.

The articles that were written then on the culture of cranberries were detrimental to their growth, and calcu-

lated to lead the beginner from the laws of nature and success in the culture of the fruit. All advocated beach sand—so poor that nothing else would grow—and the ground well saturated with water in the summer season, and flowed in the months of June and July to kill the berry worm, all of which is at variance with the proper growth of the cranberry. I have found, by experience, that they will not grow, to produce much fruit, on poor sand, unless it is underlaid with muck or peat, so near the surface that the vines will have the benefit of it. And they will make but slow growth, and produce but small crops, unless well drained in summer. And that flooding in June or July will effectually kill both berries and worms.

Cranberry bogs can be irrigated, by having water running through them in ditches. Irrigation will be a benefit in times of drouth; but should the water become stagnant, the vines will cease to grow; and if it is long continued so, they will die.

I have had the best success on muck or peat. Have had as good success without sanding as with; both have done well when properly drained, yielding from 100 to 200 bushels per acre, while the savanna land has yielded but from 15 to 40 bushels per acre.

In short, I think the success of raising cranberries is based on three points, viz.: 1st. Thorough drainage in summer. 2d. Plenty of mud or peat, destitute of loam or clay. 3d. Flooding in winter, to kill the vine worm. Hoping this may meet your views,

I remain your Friend,

THEODORE BUDD.

APPENDIX.

INSECTS INJURIOUS TO THE CRANBERRY.

Report of William C. Fish to the Cape Cod Cranberry Growers' Association in 1869.

It will be necessary for us to understand, at the outset, the different stages through which nearly all true insects pass before arriving at maturity. As an example, we will first consider the life of the

Vine Worm.

These worms hatch somewhere about the 20th of May, from eggs that have remained upon the vines all winter. These eggs are a flat, circular scale, of a honey-yellow color, and measure about 0.3 of an inch. Just before it is time for the egg to hatch, the black head of the young worm can be seen through the skin with the naked eye.

When hatched, the young worm immediately finds its way to the end of the young shoot, and commences to feed upon the tenderest leaves, drawing some of them together with its web for shelter. It is, at this time, of a pale yellow color, with a black head. In this way they continue to work, drawing more leaves together, and feeding first on the tenderest parts, and then upon the older leaves. When very numerous, by the time they are full grown, they will have eaten most of the leaves and tender shoots, leaving very little except dry stems.

They attain their full size in about two weeks from hatching, and are then about 0.45 of an inch in length, having become of a dull yellow-green, with a black head.

It now prepares to pass from the larva to the pupa stage of existence by spinning a slight cocoon among the

dead leaves, or among the litter at the surface of the ground, and within this the worm becomes a pupa, or chrysalis, as it is sometimes called. This pupa is about 0.25 of an inch in length, and is light brown.

Remaining quiet in this state for from ten to thirteen days, the pupa works its way partly out of the cocoon, the skin splits, and the moth escapes. The insect having become a moth (or miller is the common name), has arrived at its perfect, or imago state, and its mission now is to lay eggs for another brood of worms.

These moths were numerous in Eastham from the 10th of June until about the first of July. The eggs were deposited on the under side of the leaves.

It was a common theory that the eggs were "laid in the bud;" but I have never been able to find one there, and have yet to meet with the person that found the egg on that part of the plant; therefore, I am forced to conclude that it was only theory. I have seen hundreds of the eggs, and never one but it was on the under side of the leaf.

This moth is most active in the afternoon, and just at eve. The eggs that are laid in June hatch sometime about the 4th of July, and the insect passes through the same stages of existence as before, moths coming out in August, and laying eggs on the vine. These eggs remain on the vines all winter. A very few may hatch in September, but I have never succeeded in finding more than three or four in that month. The first brood is not usually so numerous as the second; but this year the first brood visited the bog of Mr. Nathaniel Robbins, of Harwich, and completely stripped the vines, eating everything that it could eat. I visited his bog on the 28th of June, and I never saw the second brood do more than this first brood did. I think this bog was under water until the first of June.

At Sandwich, on the 16th of July, there were vine

worms of the second brood nearly full grown upon one bog, while upon another, several miles away, the millers were just laying their eggs for the second brood.

Water is, and probably always will be, the most effective agent in destroying this insect. Those that have this convenient will find it best, I think, to flow their bogs once or twice between the 10th of May and the 7th of June—that is, if they let off the water early in the spring. If they keep on the water until the first of June, it would be well to flow two or three times during the month.

I think it will be difficult to find anything that can be readily applied to destroy these insects in their larva, or worm state. They live so sheltered within the leaves that they have drawn together, that it is almost impossible to reach them all, except with water.

When they have spun their cocoons, and have been changed to chrysalides, I think it doubtful if we can reach them with anything.

I hope that, in time, we shall find some way to entrap the millers and destroy them; or that something will be found that will make the vines offensive, and drive them away.

Knowing that some moths were attracted by a mixture of molasses and water, I experimented with that, and found that it did not attract this miller. I have had no opportunity to test fires, but from what I can learn from others, I think that it is an uncertain remedy, at least.

Many of these millers might be destroyed by catching them in a hand-net of muslin, and crushing them. On a large bog, this would be tedious; but on a small bog, one or two persons could soon catch most of the millers after a little practice in handling the net, going over the vines about sunset.

Sawdust, or old rags that have been soaked in kerosene, or something else offensive to insects, if scattered about

among the vines, just as the millers come out, might drive them away, although I have not tried the experiment.

"The Fruit Worm"

Is placed, by scientific men, in the same family, Tortricidæ, as the vine worm, but it is a distinct species.

It is probable that the most of us are familiar with the habits of this insect in its larva state. About the first of August, some of the small cranberries will turn prematurely red; and, on opening them, we find a small yellow-green worm feeding upon the inside of the berry. Having exhausted the interior of one, it enters another, and in this way destroys several before reaching its full size.

I took the first one this year upon the 21st of July, and at this date, August 18th, they are full grown and some have left the fruit. The above dates refer to bogs that were not flowed in the winter.

On such bogs, I have always found it hard to find the fruit worm after the first of September. They travel at night, from one cranberry to another. When full grown, they are about one-half of an inch in length, and are of a light green color, tinged with pink upon the back. The mouth is dark brown. They now enter the ground, and just below the surface, they spin a close cocoon, covered with grains of sand, or other substance, and there change to chrysalides.

This is as far as I have traced them, as all that I have tried to raise for several seasons have died after spinning their cocoons. They have to be kept over winter, to rear the moth, and they do not do well in the house.

This worm has been considered the same as the "apple worm," but it is distinct from that insect. There can be no doubt but that it is the larva of a moth, as I have high scientific authority for the statement.

Some have thought that it was similar to the curculio, and that the parent insect punctured the fruit and

laid its egg within; but there is no resemblance whatever between this insect and the curculio, except that they both destroy fruit; and there are no facts to prove that the parent insect punctures the berry.

The millers have no instruments, to my knowledge, with which they could pierce the skin of a cranberry.

One gentleman has raised "waspish" flies from these worms. So have I, after keeping the cocoons over winter; but they were ichneumons of two different species, parasites that had destroyed the worms, and were, therefore, our friends instead of enemies.

I hope to rear the moth by another spring, and if I do, will report to the Association. I watched closely to detect the moth in depositing its egg, but did not succeed.

In the absence of all facts in regard to the moth, the most natural theory seems to be that the egg is laid by the moth upon the berry just after it sets, and the egg hatching, the young worm burrows into the fruit.

The apple moth belongs to this family, and deposits its egg upon the apple in the blossom end, the egg hatches, and the worm eats its way into the fruit. I hope, in time, to learn the facts. During the first half of August, the wormy berries examined will have, in nine cases out of ten, the hole close to the stem. After the worms get larger, the hole will more frequently be on the side.

I found that by putting the berries under water, the worms would come out in a few hours, and that twenty-four hours would destroy them. I have tried twelve hours, and found that to be enough to kill most of them, although two or three had their holes stopped so tightly that the water did not reach them. It has been remarked by a friend that, where a bog can be flowed, the water is usually kept on long enough in spring to prevent these insects doing great injury; but as some are giving up the practice of late flowing, it may be found advantageous to flow some time between the 10th and 25th of August,

provided it does not injure the berries. I find a difference of opinion among growers as to the effect that water would have upon the berries at that time, and the matter could only be decided by experiment.

At their first appearance, I think it would be useless to flow, as at that time the berry is almost completely watertight.

Mr. Wm. Chipman, of Sandwich, once tried with success strewing ashes over the vines, just as the berries were setting. Mr. Joshua Cole, of Eastham, once tried tobacco water with good effect; he tried it again another year, without success.

It will be necessary for those who experiment with such things to be well posted in regard to the habits of the insects they are dealing with, as a few hours' difference in the time of using any remedy might make success impossible.

There is but one other caterpillar that has yet proved very destructive to the cranberry, and that is known as the

Black Span Worm,

although it is far from being black.

I first met with this insect at Harwich, August 25th, 1869, where I saw some that had been taken from the bog of Mr. Wm. H. Underwood, where they did much damage. They also injured the vines of Mr. Nathaniel Hinckley, of Marston's Mills.

I sent some of these span worms that were taken on Mr. Underwood's bog to A. S. Packard, Jr., M. D., of Salem, who was publishing a work on insects.

He gives a description of it in his work called "A Guide to the Study of Insects," a work that should be in the hands of every one who has insects to deal with.

Dr. Packard says of it: "It is a dull reddish-brown,

simulating the color of the twigs of the cranberry, and is finely lineated with still darker lines. The head is speckled with brown, with a conspicuous transverse band across the vertex, and two rows of pale spots across the front. Just above the spiracles is a broad, dusky band. Beneath the body is paler, with a mesial clear line, edged with brown. It is 0.8 of an inch in length."

This year I have heard from them but once. On the 3d of August, Freeman Ryder, Jr., of North Harwich, sent me a small box, by mail, containing quite a number of these span worms. I could not visit Mr. Ryder's bog until the next week, and when I did so, I found that they had all disappeared. They were not near so numerous as on Mr. Underwood's bog, last year. I think that they must go just under the surface of the ground to change to chrysalides.

Only two of those I received changed to chrysalides, and, as yet, the moth has not escaped. The chrysalis is 0.38 of an inch in length, of a mahogany-brown color, quite dark about the head.

This insect is probably only an occasional feeder upon the cranberry, for if this plant was its only food, we should find it every year upon the bogs. It has been suggested to me that the European House Sparrow might be made useful if this insect should ever become very numerous. If it would hunt out the vine worms also, and catch the millers as they come forth, it would be a very valuable friend.

The common Blue Bird is one of the greatest destroyers of small caterpillars and worms, and should be protected everywhere. This span worm feeds upon the tender shoots, and later upon the older leaves. It spins no web.

The Cecidomyia, or Gall Gnat, of the Cranberry.

We now come to an insect very different from those before described.

If you go over your vines about the middle of June, and look carefully at the tips of the growing shoots, you will notice that some of the small leaves at the end are closed together. These leaves have much the same appearance as those drawn together by the vine worm when it first commences to work in the tip of the shoot; but if you examine them, you will find that there is no web, and that the leaves have grown out of shape.

Within some of the smaller leaves, protected by those that are closed together, you will find the author of the mischief, a small, orange-colored maggot, without legs, and measuring, when full grown, but about 0.6 of an inch in length.

This maggot, when it first hatches, is white, but its color increases as it grows, until, when full grown, it is orange.

By the 30th of June, most of them will have spun a little oblong cocoon within some of the small leaves at the end of the shoot. This cocoon resembles white tissue paper, and within can be found the orange colored pupa. In this state it can readily be distinguished from the maggot by the blunt head, whereas, in the maggot, both ends are tapering.

After remaining in the cocoons about twelve days, the perfect insect, a gnat, comes forth. This gnat is 0.4 of an inch in length, its body is orange, and its wings transparent. This gnat lays the eggs for another brood of maggots. The egg of this insect is unknown to me, the insect being so small, that the egg must be quite minute.

The maggot only works among the minute tender leaves at the end of the young shoots. They have no jaws, and "must suck in the sap and moisture through the mouth, or absorb it through the skin. They make no excrement."

This insect first came under my observation in June, 1866, at Sandwich. It was very abundant at that place.

This year I went over the same bogs, and found it scarce. It seems to be widely distributed over the Cape, as I have not failed to find it on every bog I have visited.

There is a little Chalcis fly that is a parasite upon this insect, and destroys large numbers. It is doing far more than man can to keep this insect under.

I did not find this maggot numerous anywhere during the early part of the summer. On the 23d of this month I went over the bog of Mr. Nathaniel Hinckley, of Marston's Mills, and found traces of the insect everywhere; it was too late to find the insects themselves, but in some places you could scarcely find a shoot but had been checked by the maggots.

The effect of the occupation of this maggot of the tip of the shoot can be readily seen. The minute leaves and tender tip are killed, and the growth is stopped. If the shoot is strong, it may put out a shoot at the side, and this may, in turn, be checked.

I have seen a shoot start the third time, although, most frequently, they do not grow more, but form buds, from which start side shoots next year.

Mr. Hinckley and myself searched in vain for a side shoot with fruit on it. I have seen them with fruit, but rarely.

In June, I tried to drown some of these maggots, and as they moved after remaining under water fourteen days, I gave it up. Later in the season, I met with Mr. Calvin Crowell, of West Sandwich, who informed me that he had saved some of his vines by flowing; that after his bog had been flowed, he noticed that some of the shoots came right up between the leaves that were misshaped, proving that something had removed the insect. The only way that I could account for it was that the water might have washed out the maggots, and, they being without legs, could not get back to the end of the shoot. Since then, I have seen some things that led me to think

that such was the case. On Mr. Hinckley's bog I noticed numbers of these shoots that plainly showed that the insect had commenced its work, but had been removed, as the shoot kept right on. On inquiring, I found that Mr. Hinckley had flowed his bog on the 26th of June. This was, I think, rather late to hit most of them, but it probably washed out some.

After the insect has spun its cocoon, it is impossible either to wash it out or to drown it. Recently, I placed a shoot in water that contained two of these maggots; they were all I could find to experiment with. One of the two washed out, the other remained.

Probably flowing would prove more effectual when the maggots are quite small, as the leaves do not close together very tightly until the maggot is nearly full grown. I hope it will be seldom that the bogs have such a visitation as the bog of Mr. Hinckley received. If any of the members of the Association wish to see what the insects can do when numerous, they had better visit this bog. Had I known that they were so numerous there during the early part of the summer, I should have been glad to have been upon the ground, to see what results would follow flowing when the maggots first commenced their work. It would be a good plan to flow when the parent gnat is out. Some might be bred in the house, and then one would know exactly when they were out. It is usually some time about the 4th of July that the gnat comes forth.

This first brood is the most numerous, although there are other broods as long as there are growing runners. I found a few of these maggots in September, 1868.

I am not aware that this insect has ever been described by scientific men. I have, at different seasons, sent them to some of my scientific correspondents, but I cannot learn that they have published any description of it.

It is a true Cecidomyia, closely related to the minute Hessian-fly, that is so destructive at times to wheat.

I have searched many works relating to the Hessian- and Wheat-flies, hoping that some of the remedies that were used against those insects would answer for our gall gnat. Strips of woolen cloth, dipped in melted brimstone, and fastened to sticks in different parts of the field, and particularly on the windward side, are set on fire for several evenings in succession, at the time the gnats are depositing their eggs. This has been efficient in the case of the Wheat-fly, and, if thoroughly tested, it might do good in the case of some of our insects.

The minute Chalcis flies that sting the maggot, and deposit their eggs within it (which hatch, and then we have a maggot within a maggot, the inside one having the advantage, and killing its host), are doing a great work; and the Ichneumons, that work in the same way upon the fruit and vine worms, are doing much to prevent their increase. I have seen large numbers of dead vine worms this season destroyed by these parasites.

In closing my report, I wish to thank the members of the Association, and the cranberry growers generally, for the aid which they have given me, and for kindnesses which they have shown me at all times, during the three months that I have been engaged in these investigations; and if my report will induce the growers to study the habits of these insects themselves, and become acquainted with them, in a word, to become their own entomologists, I shall feel that the time which I have spent in the study of these insects has not been in vain.

A New Vine-worm—Gelechia.

A new vine-worm has recently attacked the Cranberry meadows of New Jersey. It is described by Mr. J. H. Brakeley as follows: "The Gelechia is a small moth of a dusky white color, with brown or chocolate-colored markings. It expands its wings about one-fourth of an

inch. The larva is in general appearance, like that of the Tortrix, and a very little smaller. The chrysalis also is similar. The flight of the moth is quite rapid, and the quick motion of its wings in flight give it the appearance of a fly rather than that of a moth. There are but two broods in the year. The first brood of larvæ come from the eggs laid in the preceding August, which remain on the vines during the winter; the larvæ make their appearance soon after the removal of the water in the spring. The eggs are about one-fiftieth of an inch in diameter, and may be found on the under side of the leaf. From one to two weeks from the time the water is drawn from the bog, the presence of the young larvæ may be detected by the two terminal leaves of the vine being drawn together and fastened by a web. As these leaves, when drawn together, expose their under or lighter sides, it is readily noticed. As this occurs before the vines have commenced growing, they devour the bud and then the leaves, and, as they increase in size, draw together several uprights of the vines, the same as the larvæ of the Tortrix. In a short time most of the leaves will be eaten up, and little will be seen except the old, dark-looking vines. After attaining their growth, they pass into the chrysalis state, and the moths appear early in June, two or three days before those of the Tortrix. These will spread themselves over other portions of the bog, seeking "pastures new" on which to deposit their eggs for the second brood of larvæ. This brood appears in July, and continues the work of destruction up to or past the middle of the month; they then pass into the chrysalis state, and are followed by the second brood of moths early in August. When the eggs of these moths are deposited upon the vines, their work for the year is completed, and they gradually disappear, none of them surviving the winter."

The remedy for the "Gelechia" is to submerge the

infested vines several times after taking the water off in the spring. The water should be put on every ten days during the month of May, and allowed to remain ten hours. This treatment allows the eggs to hatch, and the young worms are quickly drowned. Where water is scarce, defer flowing until late winter, thus exposing the eggs to severe cold, which is thought to destroy them.*

The "Scald" or Rot.

In an essay on this subject Mr. J. A. Fenwick says: "When Cranberries on the vines are softened and become semi-transparent, or like partly cooked berries, it has become common to say that they are "scalded." This softening does sometimes result from water covering them, and becoming hot and stagnant, but it generally occurs in a dry time, without water, and it is a misnomer to call it a scald. This roasting, rather than scald, which has destroyed the crop of berries so very much for a few years past, has been most destructive at the time of gathering the crop, or shortly before, the fruit as it approaches ripening being more sensitive to a high temperature. Only in extreme cases do large spaces in August, or before that, become generally softened while they are yet green, but have obtained some size. The effect of high heat is to produce spots in the fruit, the inner structure being disorganized, as shown by transparent spots, which grow larger on a repetition of the heat, particularly in muggy, wet weather, either on the vines or after being picked; but some fruit in fair weather will dry up and the rest of the berries remain sound.

"The effect of high temperature, when the fruit has but just formed, or until it is of some size, is to dwarf it, leaving it at picking time but little larger than it was when the blossom dropped from it.

* Since the above was in type, Mr. White informs us that the insect is *Anchylopera vacciniana*, Packard, for several years destructive in New England.—Ed.

"These facts being admitted, it would be wise not to advance southward with this cultivation. If the berries will soften here occasionally and partially with high temperatures at picking time, when the fruit is fully colored, we of course could advance to some point south of this, where the berries would be colored in the hot weather, and as a result, be softened every season. Consequently, I believe this cultivation will be prevented from advancing very far south of the State of New Jersey, unless it should be in elevated mountain districts. To the northward, we would reach a point at which the coloring of the fruit to perfection, and the time for freezing weather, would come together; hence the berries would always be frozen soft before picking if they were left until they were colored. In my judgment this culture cannot extend beyond 45° of north latitude.

"The only thorough and complete remedy which we have for this scald, is irrigation through the means of frequent ditches. A patch meagerly covered with vines would in time be partially remedied by the production of a dense covering, or perhaps by the application of manure to a poverty-stricken soil, to encourage the growth, of a covering of the ground. An increased quantity of ditches, in a bog considered too dry to need them, may also assist in preventing scald, as the vines would root deeper, and consequently would not suffer with a severe drouth. These, with a judgment to select a soil and situation which has the requisite moisture with drainage, are the only means that I can think of to prevent this trouble.

"These conclusions are the result of a number of observations of the weather for the past fifteen years, and some of these I shall enumerate and comment upon to show, in a measure, how they were derived.

"I have seen Cranberries in an open-top glass jar, good, sound fruit, one half softened from the effect of the sunlight, which shone through a window upon that

half. The other half, where the sun did not reach, were left sound. Good sound berries, picked and left standing in the sun, in a box or barrel, on hot days will soften upon the top. The sun's rays shining through a window on berries stored in a building, will soften them wherever the direct rays fall upon them at mid-day, or if the thermometer reaches seventy-five in the shade at the time, they will become soft.

"The evidence is positive that berries exposed to the sun's rays, at the time the temperature is at eighty or more in the shade, will be softened; that is, if they are picked. But if the vines are suffering from drouth, and fail to supply the fruit hanging upon them with moisture, is not the effect in cutting short the supply the same as if we pick the berries? It is evident that, at high temperatures, the fruit evaporates water from its skin, and this, carrying off caloric in a latent form, keeps the internal structure cool, and so prevents the disorganization of its parts. It is evident also, that moist surfaces of ground must be cooler than dry ones, and the berries growing upon them will be at a lower temperature from the evaporation of its moisture.

"Let us suppose a bog with frequent ditches, and the water kept at a uniform depth from the surface in every part, and a 'Scald' comes on; the fruit on some parts of it may be softened, and on others not. I have examined the sub-soil in places where the fruit was softened, and it was coarse gravel, for this or some other reason, it was unable to raise the moisture to the surface by capillary attraction, and had acquired a higher temperature at the surface where the soft berries were than elsewhere.

"I have seen the berries soften on surfaces black with shallow layers of muck, while a few feet from them, on a surface of white sand, berries escaped, the sub-soil being the same in both places. A thermometer placed among

the vines on the blackened surface, indicated 8° higher than on the whitened one. I have found that fruit, picked from vines that do not hide the ground, is unsound. It has been so for many years in my experience.

"A few years since, about the first week in September, I visited, before daylight in the morning, a natural bog, with a heavy crop of fruit, and found the vines and fruit everywhere covered with frost; but an hour or two after sunrise, on some parts of the bog, the fruit was softened, and on others not. Where the soil was sandy, and the vines comparatively short, with the fruit exposed to view, and the weather, there were no softened berries. But when hidden from view by grass, on mud bottom, and where there was a mulch of old grass, and there were vines between the soil and fruit, the berries were softened. The same thing was noticed on several other occasions; I can only explain it by supposing that sand, with less mulch upon it, was a better conductor of caloric than the mud, with its heavy mulch. The fruit over the sand began to thaw first, from the warmth of the earth, and increased warmth of the day. The thawing was done slowly, and the berries were not softened, but no thawing was done on the muddy and heavily mulched ground until the direct rays of the sun shone upon the berries, and thawed them rapidly enough to break up their structure. By sanding vines subject to softening by frost, the trouble has been in a great measure prevented.

"I have seen fruit with the defective spots dried up, and appear not to spread; not unlike the dry, rotten spots in apples; and I feel that the rapid spread of the scald is caused by the moist, rainy weather, acting on berries rendered defective by the previous drouth. This would explain all the loss that occurred after the rains began, except on those bogs that were covered by water.

"In June last, I set two women at work picking three rows of gooseberries in my garden. These rows

were about ninety yards long, sloping downward from some large trees at the top of the garden to moist land at the bottom. The soil is good, rich sand, that produced annually good crops of vegetables. The pickers began at the top near the trees, at seven o'clock in the morning, each taking a row, leaving one row unpicked; by eleven o'clock, they had picked two-thirds of the way down the two rows, and by that time the fruit on the upper end of the remaining row was softened half way down it by the heat and drouth, the thermometer standing at 90° in shade at the house. The parts of the rows on the lower or moister end were not softened. The softened gooseberries appeared very similar to the softened cranberries, and it struck me at once that they were made soft from exactly the same causes. That is, extreme high summer temperature, with an absence of the necessary moisture for the functions of the plant producing them, and perhaps the light in the direct rays of the sun."

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